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# Cambridge Natural Science Manuals

BIOLOGICAL SERIES.

GENERAL EDITOR:—ARTHUR E. SHIPLEY, M.A.

FELLOW AND TUTOR OF CHRIST'S COLLEGE, CAMBRIDGE.

## FLOWERING PLANTS

AND

## FERNS.

VOLUME II.

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A MANUAL AND DICTIONARY  
OF THE  
FLOWERING PLANTS  
AND  
FERNS

BY

J. C. WILLIS, M.A.,

DIRECTOR OF THE ROYAL BOTANIC GARDENS, CEYLON,  
SOMETIME FRANK SMART STUDENT, GONVILLE AND CAIUS COLLEGE, CAMBRIDGE  
AND SENIOR ASSISTANT IN BOTANY IN THE UNIVERSITY OF GLASGOW

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## PART II.

THE CLASSES, COHORTS, ORDERS, AND CHIEF  
GENERA OF PHANEROGAMS AND FERNS.

*ALPHABETICALLY ARRANGED UNDER THEIR  
LATIN NAMES.*



## EXPLANATORY INTRODUCTION

### TO PART II.

This part of the book is arranged in alphabetical order, under Latin names. The whole of the classes, cohorts and natural orders are included, as well as several thousand genera, including all the British genera, most of the common European and American genera, and the chief tropical and southern genera. Hardly any important genus has been omitted, and even in studying such a collection as that at Kew, the student will find the majority of the genera treated in this work.

The name of the genus is followed by the abbreviated name of the botanist who so named it, *e.g.* *Abelia* R.Br. means that Robert Brown was the author of this genus as thus constituted. The names adopted in this work are in general those given in the *Index Kewensis* (Oxford, 1892-3), and a reference to that work will enable the original description of the genus to be found. A list of abbreviations of authors' names is given below. In several cases the name of the genus is due to a pre-Linnaean botanist, *e.g.* Tournefort, and is adopted by Linnaeus: this is indicated thus: *Acer* (Tourn.) Linn. The same rules apply to the names of the individual species mentioned. A species has always two names, the generic and the specific; *e.g.* *Abies pectinata* DC. means the species *pectinata* of the genus *Abies*, and indicates at the same time that this plant was so named by De Candolle.

The use of the authority after the name of a plant is rendered necessary by the confusion of nomenclature that exists in Botany. The same species or genus often has two or more names, given to it by different authors or at different times. The usual rule in such cases is to use the name that was first applied to the plant, and to regard the others as *synonyms*; but if this rule be followed up too far, no stability can be assured, and it is customary therefore not to give up a long established name in favour of an older one that has been unearthed by antiquarian research.

The study of systematic botany is rendered much more troublesome than it need be by the number of synonyms that exist, and the same cause has much increased the bulk of this work. An attempt has been made to include the more common and important synonyms. *E.g.* under



*Abies*, there is a list of names frequently met with in gardens, and opposite to each of these is given the name used in this work; thus *Abies alba* Michx. must be looked for under *Picea*, *Abies Douglasii* Lindl. under *Tsuga*, and so on. In the same way the genera are often much confused by synonymy. We have seen (Ch. II.) that it is very difficult to decide when the divergence of two forms is sufficient to entitle them to rank as genera, and this difficulty is the cause of much synonymy. A genus *A* is established by one author, and then it is discovered not to differ sufficiently from another genus *B*, established by the same or another author, to remain as an independent genus. *A* is therefore merged in *B* and becomes a synonym. The species of *A* retain as far as possible their old specific names when placed in *B*. When an entry such as "*Abelmoschus* Medic. = *Hibiscus* Linn." is found, it means that the genus *Abelmoschus* as established by Medicus is merged in *Hibiscus* of Linnaeus. In this case many of the species have entirely changed their names, e.g. *A. venustus* to *H. spectabilis*; but some have retained their specific names, e.g. *A. splendens* has become *H. splendens*. This latter case is often indicated by putting the name of the old genus in brackets after that of the new, thus, *H. (A.) splendens*. In many cases the names of some of the genera thus merged in other genera are indicated thus: *Apium* (Tourn.) Linn. (incl. *Helosciadium* Koch); no attempt however has been made to give all such cases or even a fraction of them, but only a few of the more important. In particular those have been given where the genus as here defined differs from the definition in Engler and Prantl's *Natürliche Pflanzenfamilien* by the inclusion or exclusion of other genera. [For further information as to nomenclature see Asa Gray's *Structural Botany*, ch. x.]

The name of the genus is followed by that of the natural order to which it belongs, and after this is often a number (in brackets) indicating the section of the order; thus *Abelia* belongs to Section III of *Caprifoliaceae*. *Acaena* to Section III. 9 of *Rosaceae*. The general plan upon which the book has been constructed, and the necessity for condensation, render it essential, if the full advantage is to be derived from its use, that the student should refer to the natural order as well as the genus. There he will find the important general characters possessed by the members of the order, and should examine the genus to see in what it agrees, and in what it disagrees, with these. A further reference to the classification given at the end of the article upon the order will point out the special characters to be looked for in the genus as a member of some particular sub-order or tribe. In this way a large amount of information about the particular plant in question may be obtained, and at the same time the student will get into the way of regarding plants not as so many independent and disconnected units, but as related members of one great whole. In this way too he will soon acquire an appreciation of the relative importance of the different characters in classification (see Ch. II) and will learn to

recognise the approximate relationships of most plants after a brief inspection, or even at sight.

The natural orders are those given by Engler in his *Syllabus* and in *Die natürlichen Pflanzenfamilien* (see Ch. II), but sufficient reference is made to Bentham and Hooker's system of classification to enable any one who may prefer to use that system, or that of Eichler and Warming, to do so.

The name of the natural order is followed by a statement of the number of species in the genus, and its geographical distribution. The number, unless very small, is always only an approximation; new research is always bringing new species to light, splitting up older ones, or combining two or more into one. This is all the information that is given about a very large number of the genera; only when a genus presents some character of interest which is not common to the order or group, is any particular mention made of it. The biological peculiarities of the most important genera are dealt with pretty fully, but much has been omitted. Thus in dealing with the pollination-methods of flowers a selection of important genera, illustrating the various methods, has been made for description in this part; so too with epiphytes, xerophytes, the morphology of parts, and so on. General discussions of all these subjects will be found in Vol. I, and numerous examples are there quoted; these examples are mostly dealt with in full in this part. Innumerable cross-references to other articles and to Vol. I are made, and should be looked up; those referring to Part II always quote the article and never the page, whilst those referring to Part I always quote the page, so that all references thus: p. 189, refer to Vol. I.

While in the morphology &c. a selection has thus been made of genera for treatment, this is not the case with economic botany. This has been very fully treated, only a comparatively few genera being omitted. Space, however, has not permitted of a detailed description of economic products or the way in which they are obtained; for this reference must be made to other works (see Ch. IV).

Turning now to the articles upon the natural orders, the same general principles apply to them. After the name of the order is given the cohort in Engler's system to which it belongs. This should be looked up in Ch. II; this will show the orders which are most nearly related to the one under consideration, and the characters that distinguish one from the other can be made out by comparison of their descriptions in Part II. The student should always endeavour to make out why a given order is classified in the position assigned to it. When the order as defined by Engler differs from that defined by Bentham and Hooker, as is so often the case, an attempt should be made to discover the reasons for the difference.

After the position of the order in the system follows the number of its genera and species, the morphology and natural history of its

vegetative and reproductive organs, its economic products, and finally, in the case of the more important orders, its classification into sub-orders and tribes, with the more important genera belonging to each. The student should work through this part and study as many of the genera as possible before leaving the order. This is easily managed in dealing with the outdoor collections in our botanic gardens.

No particular attempt is made in this part of the book to avoid technical terms. When a term is used that the reader does not understand he should refer to the Index, where an explanation will be found or a reference made to Vol. I, in which the terms used are mostly explained. A list of abbreviations is given below. References are frequently made to works of reference; some of these are given in an abbreviated form and the explanation is given below.

### LIST OF ABBREVIATIONS USED

The descriptions of the morphology of the flower are largely given by aid of the symbols of floral formulae, which are explained in Vol. I, p. 80.

When the name of a genus or order is repeated in the article dealing with it, it is represented by the initial letter only, thus, in the article *Abies*, *A.* stands for *Abies* throughout, except in the first line

|                           |                              |
|---------------------------|------------------------------|
| ♂, hermaphrodite.         | ⊥, at right angles to.       |
| ♂, male.                  | , parallel to                |
| ♀, female                 | =, equal to, or merged in    |
| ∞, indefinite or numerous |                              |
| A, androecium.            | C, corolla                   |
| abt, about                | Cal, Caled, Caledonia.       |
| Abyss., Abyssinia.        | Calif, California.           |
| Afr., Africa              | caps, capsule                |
| album., albuminous.       | Cent, Cential                |
| alt., alternate.          | cf, compare                  |
| Am., America.             | Chi, China                   |
| amphitrop, amphitropous   | coh, cohort                  |
| anat, anatropeous         | Col, Colony                  |
| anatrope., do.            | cor., corolla                |
| apocp., apocarpous.       | cosmop, cosmopolitan         |
| Arch, Archipelago.        | cpl, carpel.                 |
| Archichl, Archichlamydear | Dicot, Dicotyledons          |
| art., article.            | diplochiam, diplochlamydeous |
| As., Asia                 | E, East.                     |
| Atl, Atlantic.            | eg, for example              |
| Austr., Australia.        | E. Ind, East Indies          |
| B. & H, Bentham & Hooker. | esp., especially.            |
| Benth.-Hook, do.          | Eur, Europe                  |
| Braz., Brazil.            | exalb., exalbuminous         |
| Brit., Britain, British.  | exc., except.                |

|                                  |                              |
|----------------------------------|------------------------------|
| excl., excluding.                | ov., ovule, ovary.           |
| exstip., exstipulate.            | P., perianth.                |
| flr., flower                     | p., page.                    |
| frr., fruit.                     | pet., petal.                 |
| G., gynœceum.                    | Phil. Is., Philippine Isles. |
| Gamopet., Gamopetalae.           | plac., placenta.             |
| gen., genus                      | plt., plant                  |
| Hemisph., Hemisphere.            | Polynes., Polynesia          |
| heterochlam., heterochlamydeous. | Polypet., Polypetalae.       |
| homochlam., homochlamydeous.     | pt., point.                  |
| horiz., horizontal.              | q v., which see.             |
| I., Island.                      | recept., receptacle.         |
| incl., including.                | reg., regular.               |
| Ind., India                      | S., South                    |
| Indo-mal., Indo malayan region   | Sandw. Is., Sandwich Isles   |
| inf., inferior                   | sp., species.                |
| infl., inflorescence.            | spec., specific              |
| irreg., irregular.               | sta., stamen.                |
| K., calyx.                       | stip., stipule, stipulate.   |
| lat., lateral                    | sub-trop., sub-tropical      |
| lf., leaf                        | sup., superior               |
| -loc., loculus, locular.         | Sympet., Sympetalae.         |
| Madag., Madagascari              | syncp., syncarpous           |
| Masc., Mascarenes                | Tasm., Tasmania.             |
| Medit., Mediterranean region     | temp., temperate             |
| Mex., Mexico                     | trop., tropical.             |
| Moluc., Moluccas.                | uniloc., unilocular.         |
| Mts., Mountains                  | unisex., unisexual.          |
| multi-loc., multi-locular        | U S., United States          |
| N., North                        | var., variety                |
| New Caled., New Caledonia        | W., West                     |
| N Z., New Zealand                | W. Ind., West Indies.        |
| opp., opposite                   | zygom., zygomorphic.         |
| orthotrop., orthotropous         |                              |

## ABBREVIATIONS OF AUTHORS' NAMES

The chief of these are.

|                        |                         |
|------------------------|-------------------------|
| Adans., Adanson.       | Cass., Cassini.         |
| Ant., Anton            | DC., A. P. de Candolle. |
| Arn., Arnott           | Dcne., Decaisne.        |
| Aubl., Aublet.         | Desf., Desfontaines     |
| Bab., Babington.       | Dill., Dillenius        |
| Balf., Balfour.        | Eichl., Eichler.        |
| Beauv., Beauvois       | Ell., Elliott.          |
| Benth., Bentham.       | Endl., Endlicher.       |
| Boiss., Boissier.      | Forsk., Forskål.        |
| P. Br., Patrick Browne | Forst., Forster         |
| R. Br., Robert Brown.  | Gaertn., J. Gaertner.   |

## xii ABBREVIATIONS OF AUTHORS' NAMES

|  |                            |
|--|----------------------------|
| Gaudich., Gaudichaud.                        | F. Muell., F. von Mueller. |
| Griseb., Grisebach.                          | Nutt., Nuttall.            |
| Harv., Harvey.                               | Nym., Nyman.               |
| Haw., Haworth.                               | Parl., Parlatore.          |
| H. B. & K., Humboldt, Bonpland<br>and Kunth. | Pav., Pavon.               |
| Hochst., Hochstetter.                        | Pers., Persoon.            |
| Hoffm., Hoffmann.                            | Plum., Plumier.            |
| Hook., W. J. Hooker.                         | Poir., Poiret.             |
| Hook. f., J. D. Hooker (son).                | Raf., Rafinesque.          |
| Huds., Hudson.                               | Rchb., Reichenbach.        |
| Jacq., N. F. Jacquin.                        | Reinw., Reinwardt.         |
| Juss., A. L. Jussieu.                        | Rich., L. C. Richard.      |
| L., Linnaeus.                                | Riv., Rivinus.             |
| Labill., La Billardière.                     | Roem., J. J. Roemer.       |
| Lag., Lagasca.                               | Rottb., Rottboell.         |
| Lam., Lamarck.                               | Roxb., Roxburgh.           |
| Lamb., Lambert.                              | St Hil., St Hilaire.       |
| Ledeb., Ledebour.                            | Salisb., Salisbury.        |
| Lehm., Lehmann.                              | Schrad., Schrader.         |
| Lem., Lemaire.                               | Schreb., Schreber.         |
| L'Hérit., L'Héritier.                        | Schult., Schultes.         |
| Lindl., Lindley.                             | Spreng., Sprengel.         |
| Linn., Linnaeus.                             | Sw., Swartz.               |
| Linn. f., C. Linnaeus (son).                 | Thoms., T. Thomson.        |
| Loefl., Loeffling.                           | Thunb., Thunberg.          |
| Mart., Martius.                              | Torr., Torrey.             |
| Medic., Medicus.                             | Tourn., Tournefort.        |
| Michx., Michaux.                             | Vaill., Vaillant.          |
| Mig., Miguel.                                | Wall., Wallich.            |
| Morr., Morren.                               | Welw., Welwitsch.          |
| Muell.-Arg., J. Mueller (Argau).             | Wendl., Wendland.          |
|  | Willd., Willdenow.         |

The abbreviation Hort. signifies a name current in gardens but without any official scientific basis.

## LITERATURE QUOTED.

Numerous references are made to standard works and to papers in botanical periodicals; many are given in abbreviated form. The chief are :

Amaz., Wallace's *Travels on the Amazon*.

Ann. of Bot., *Annals of Botany*; Oxford.

Ann. Buitenz., *Annales du jardin botanique de Buitenzorg*; Leyden.

Beiträge, Cohn's, *Beiträge zur Biologie der Pflanzen*, ed. by F. Cohn.

Berichte D. Bot. Ges., *Berichte der deutschen botanischen Gesellschaft*; Berlin.

Blüthendiag., Eichler's *Blüthendiagramme*; Leipzig 1878.

- Bot. Cent., *Botanisches Centralblatt*; Cassel.  
Bot. Gaz., *Botanical Gazette*; Madison, U.S.  
Bot. Jaarb., *Botanisch Jaarboek*; Gent.  
Bot. Jahrb., Engler's *Botanische Jahrbücher*; Berlin.  
Bot. Jahresb., Just's *Botanischer Jahresbericht*; Berlin.  
Bot. Zeit., *Botanische Zeitung*.  
Fert. of Flrs., Müller's *Fertilisation of Flowers*; London 1883.  
Flora, *Flora*, ed. by Goebel; Marburg.  
Linn. Soc. Journ., *Journal of the Linnean Society*; London.  
Nat. Hist. of Plts., Kerner's *Natural History of Plants*; London 1895.  
Nat. Pfl., Engler & Prantl's *Natürliche Pflanzenfamilien*; Leipzig  
(in publication).  
Nat. Science, *Natural Science*; London.  
Orig. of Cult. Plts., De Candolle's *Origin of Cultivated Plants*;  
London 1882.  
Pflanzenbiol. Sch., Goebel's *Pflanzenbiologische Schilderungen*; Mar-  
burg 1891.  
Pflanzengeog., Drude's *Handbuch der Pflanzengeographie*.  
Prings. Jahrb., Pringsheim's *Jahrbuch für wissenschaftliche Botanik*;  
Berlin.  
Treas. of Bot., *The Treasury of Botany*; London.  
Tropenreise, Haberlandt's *Botanische Tropenreise*; Leipzig 1893.

Other works of reference are mentioned at the ends of the various chapters in Part I.



## PART II.

**Abelia** R.Br. Caprifoliaceae (III). 11 sp. Asia, Mexico. United to *Linnaea* in *Nat. Pfl.*

**Abelmoschus** Medic. = *Hibiscus* Linn.

**Aberia** Hochst. Flacourtiaceae. 11 sp. Afr., Ceylon. The fruits of *A. caffra* Harv. et Sond., and others, are edible. United to *Doryalis* in *Nat. Pfl.*

**Abies** (Tourn.) Linn. *Synonymy*: *A. alba* Michx. = *Picea alba*; *A. alba* Mill. = *A. pectinata* DC.; *A. americana* Mill. = *Tsuga canadensis*; *A. californica* Hort. = *Tsuga Douglasii*; *A. canadensis* Michx. = *Tsuga canadensis*; *A. Cedrus* Poir. = *Cedrus Libani*; *A. Deodara* Lindl. = *C. Deod.*; *A. Douglasii* Lindl. = *Tsuga D.*; *A. excelsa* Link = *A. pectin.*; *A. excelsa* Poir. = *Picea exc.*; *A. Kämpferi* Lindl. = *Pseudolarix K.*; *A. Larix* Poir. = *Larix europaea*; *A. montana* Nym. = *Picea excelsa*; *A. nigra* Desf. or *Duroi* = *P. nigra*; *A. orientalis* Poir. = *Picea or.*; *A. pectinata* Poir. = *P. rubra*; *A. Picea* Lindl. = *A. pectinata* DC.; *A. Picea* Mill. = *P. excelsa*; *A. rubra* Poir. = *P. rubra*; *A. vulgaris* Poir. = *A. pectinata*. For further synonymy see Index Kewensis.

Coniferae (Arauc. 1 b; see C. for genus characters). 20 sp. N. temp. The firs are evergreen trees with needle leaves borne directly on the stems. On the main stem the symmetry is radial, whilst on the horizontal branches the leaves twist so as to get their surfaces all much in one plane. If the top bud be destroyed, however, a branch bud below it takes up the vertical growth and radial symmetry.

The cones are large and arranged much like those of *Pinus*. The female is often brightly coloured, though the C. are wind-fertilised (see p. 95). The carpel-scales are large and appear on the outside of the cone between the ovuliferous scales. The cone ripens in one year.

*A. pectinata* DC. is the silver-fir, common in the Mts. of S. Eur.; it yields a valuable wood, "Strasburg" turpentine (see *Pinus*) etc. *A. balsamea* Mill. (East N. Am.) is the balsam fir, yielding the pure form of turpentine known as Canada balsam, used in optical and microscopical work. Many other sp. of *A.* are also valuable.

**Abobra** Naud. Cucurbitaceae (III). 1 sp. temp. S. Am.

**Abronia** Jacq. Sterculiaceae. 9 sp. trop. As. to Austr.



**Abronia** Juss. Nyctaginaceae (1). 12 sp. N. Am. Anthocarp winged.

**Abrus** Linn. Leguminosae (III. 9). 6 sp. trop. *A. precatorius* L. is well known for its hard red seeds (crab's eyes), strung into necklaces, rosaries &c., and used as weights in India. Their colour is said to attract birds, but they are quite inedible.

**Abutilon** Tourn. Malvaceae (11). 80 sp. trop. Many are grown in hot-houses. There is no epicalyx. The mechanism of the flr. is like that of *Malva* (esp. *M. silvestris*) but in some of the sp. most frequently cultivated, the flrs. are quite self-sterile, and the sta. do not move downwards, but the styles emerge through the mass of anthers, the pollination they thus receive producing no effect. Many sp. are visited by humming-birds (p. 103).

**Acacia** (Tourn.) Linn. Leguminosae (I. 2). 450 sp. trop. and sub-trop. They are mostly trees; the typical leaf-form is a bipinnate leaf with numerous leaflets and small scaly stipules. Numerous departures from this type are found. A great number of sp. (280), forming the section *Phyllodineae* occurring in Australia and Polynesia, have simple leaf-like *phyllodes*, i.e. petioles flattened so as to place their surfaces vertically—this of course exposes less surface to radiation. A mere inspection, though it shows the phyllode to be a leaf-structure (it has an axillary bud), does not show that it is not a leaf turned edgewise, though the fact that it shows no twist at the base would go to prove this. Occasionally however there are "reversions to type" on the plant, some phyllodes occurring with leaf-blades at their ends, of the ordinary bipinnate type. This is still better seen in germinating seedlings, which apparently recapitulate to some extent their own ancestral history (p. 113). The first leaves are typical bipinnate leaves; they are followed by others with slightly flattened stalks and less blade and so on, until finally only phyllodes are produced. In *A. alata* R.Br. and others, the phyllodes are decurrent on the stem, like the leaves of thistles. Another feature that varies much is the stipules. In many sp. they are represented by large thorns, swollen at the base. In *A. sphaerocephala* Cham. et Schlecht., a Cent. Amer. sp., the thorns are inhabited by colonies of ants, which bore into them and clear out the internal tissue. The ants live only on the A. and are fed by it. Extrafloral nectaries occur on the petioles and curious yellow sausage-shaped 'food-bodies' on the tips of the leaflets. These consist of parenchymatous cells containing food-stuffs and are eaten by the ants (cf. *Cecropia*). If any attempt be made to interfere with the tree, the ants rush out and attack the intruder. A most efficient protection is thus afforded to this myrmecophilous *Acacia*. (See *Cecropia*, and *Nature*, Aug. 1893, where an account of the leaf-cutting ants, the chief foes of the A., will be found. This was the first case of myrmecophily discovered; see Belt's *Naturalist in Nicaragua*.)

A few *Acacias* are twiners, others hook-climbers. The flower

has  $\infty$  long stamens, affording little or no protection to the pollen. The fruit is of the usual types. In *A. homalophylla* A. Cunn. the seed hangs out on a long red funicle which may attract birds.

Many Acacias yield valuable products. *A. Senegal* Willd. (Soudan) yields gum-arabic; the gum exudes from the branches "principally during the prevalence of the dry desert winds from the N. and E. which blow in the winter after the rainy season." Other species yield inferior qualities of gum. *A. Catechu* Willd. yields Catechu or cutch (used in tanning), which is got by digestion of the wood in hot water. The wood of other species is valuable in the arts, especially that of the Australian black-wood, *A. Melanoxylon* Willd.

**Acaena** Linn. Rosaceae (III. 9). 40 sp. S. Am., Mexico, Polynes. The fruit is hooked like that of *Agrimonia*.

**Acalypha** Linn. Euphorbiaceae (A II. 2). 225 sp. trop. The anther lobes are curiously twisted. The stigmas are very large and branched. In *A. indica* L. there are normal  $\varnothing$  flowers at the base of the infl., then  $\sigma$ , and at the apex a single  $\varnothing$  with only one ovule, whose seed has the radicle facing downwards and has no caruncle (Clarke).

**Acampe** Lindl. Orchidaceae (31). 10 sp. E. Ind., China, Afr.

**Acanthaceae**. Dicotyledons (Sympet. Tubiflorae). 134 gen. with 1600 sp. They are chiefly tropical, but occur also in the Medit. region, U.S., Australia, &c. Many biological types occur in the order—climbing plants, xerophytes, marsh plants, &c.—and there is therefore much variety in habit. Trees are rare, most A. being shrubs or herbs with opposite exstipulate leaves, which are usually thin and entire. The most common type of infl. is a dichasial cyme, which in its ultimate branchings tends to become monochasial, as is so often the case. Frequently this cyme is condensed in the leaf-axils as in Labiatae. Racemose infls. also occur. Bracts and bracteoles are usually present, often coloured; the latter are frequently very large, more or less enclosing the flr.

The flower is  $\varnothing$ , hypogynous, zygomorphic, usually with a disc below the ovary. K (4—5), C (4—5), commonly two-lipped (the upper lip is sometimes not developed, e.g. in *Acanthus*). Sta. rarely 5, usually 4 or 2; staminodes frequently represent the remainder of the whorl. The stamens are epipetalous; anthers very commonly with one lobe smaller than the other, or even abortive; connective often long (cf. *Salvia*). The pollen exhibits a very great variety of patterns (see Lindau in *Nat. Pfl.*). The ovary stands on a nectariferous disc. G (2), bilocular with axile placentae each with 2— $\infty$  ovules in two rows, usually anatropous. Style usually long with two stigmas. The general arrangement of the flower for visits of insects, protection of pollen &c. is like that of Labiatae or Scrophulariaceae.

The fruit is a bi-locular capsule (with few exceptions), usually more or less stalked, and loculicidal to the very base. Seeds usually exalbuminous. Their modes of distribution are interesting (see

Lindau, *loc. cit.*). The capsules of Acanthoideae explode and the seeds are thrown out, largely by the aid of peculiar hook like outgrowths from their stalks (*retinacula* or *jaculators*). Many have superficial scales and hairs which on wetting become mucilaginous and may thus aid in animal distribution or in anchorage of the seed to its place of germination (cf. *Linum*, *Collomia*). For examples, see *Crossandra*, *Ruellia*, *Blepharis* &c

*Classification and chief genera* (after Lindau)

I *NELSONIOIDEAE* (Ovules  $\infty$ , jaculators papilla shaped)  
Staurogyne, *Nelsonia*.

II *MENDONCIOIDEAE* (Ov. 4, seeds not more than 2  
Drupe; no jac). *Mendoncia*

III *THUNBERGIOIDEAE* (Ov 4 Capsule, jac papilla  
like) *Thunbergia*, *Meyenia*

IV *ACANTHOIDEAE* (Ov 2— $\infty$  Capsule, jac hook  
shaped)

A. *Contortae* (cor convolute, or never ascendingly imbricate) *Strobilanthes*, *Ruellia*, *Eranthemum*, *Baileia*

B. *Imbricatae* (cor ascendingly imbricate, or with no upper lip) *Blepharis*, *Acanthus*, *Crossandra*, *Aphelandra*, *Justicia*

**Acantholimon** Boiss Plumbaginaceae 80 sp Orient Mostly desert plants with spiny leaves (see p 183)

**Acanthopanax** Miq Araliaceae 6 sp trop As, Japan

**Acanthophippium** Blume Orchidaceae (1-) 4 sp Indo Mal The axial outgrowth from the base of the column, common in O, is here very great and bends first downwards, then up removing the insertion of the lateral sepals and labellum to a distance from the column

**Acanthophoenix** H Wendl Palmae (iv 6) 3 sp Mascarenes

**Acanthophyllum** C A Mey Caryophyllaceae (1 2) 18 sp W As  
Siber Mostly desert xerophytes with prickly leaves (see p 183)

**Acanthorhiza** H Wendl Palmae (1 2) 4 sp trop Am The adventitious roots that spring from the lowest nodes grow normally downwards into the soil, but those from the nodes above develop into numerous thorny branches, and never reach the earth

**Acanthosicyos** Welw Cucurbitaceae (iii) 1 sp. S W Afr, *A. horrida* Welw, a remarkable plant growing on sand dunes The root, several inches thick, is very long (up to 40 ft). Above ground is a thorny shrub, about 3 ft high, with long tendrils; the thorns are modified twigs. The fruit is eaten by Hottentots (See Welwitsch, *Trans Linn Soc.* 27, 1869)

**Acanthostachys** Link, Klotzsch, et Otto. Bromeliaceae (1) 1 sp. (*A. strobilacea*) Brazil, usually placed in *Ananas*.

**Acanthus** Tourn. Acanthaceae (iv. B) 20 sp. trop and subtrop, As, Afr., Eur, mostly xerophytes with thorny leaves (those of *A. spinosus* L furnished, it is supposed, the pattern for the decoration of the

capitals of Corinthian columns). *A. ilicifolius* L. forms part of the mangrove vegetation of trop. As., Afr., &c. (see p. 188). The flower is a large bee-flower; there is no upper lip to the corolla, and the protection of the pollen, &c. is undertaken by the calyx. The anthers form a box by fitting closely together at the sides; they shed their pollen sideways into this box, where it is held by hairs till an insect probing for honey forces the filaments of the stamens apart and receives a shower of pollen on its head (cf. many Scrophulariaceae, Ericaceae, &c.). In the young flower the style is behind the anthers, later on it bends down so as to touch a visiting insect. The fruit explodes, as usual in the order, and there are large 'jacula-tors' on the seeds.

**ACER** (Tourn.) Linn. Aceraceae. 100 sp. N. temp., in mountain or hill districts (*A. Pseudoplatanus* L., the sycamore, and *A. campestre* L., the maple, in Britain, the latter native). They are trees and shrubs, with opposite exstipulate leaves, deciduous or evergreen. Some have simple entire leaves; more commonly the leaf is 3- or 5-lobed, and occasionally compound. An interesting exercise is to go through a collection of *Acers* in a herbarium or elsewhere, comparing the leaf-tips as to degree of development of the acuminate "drip-tips" (see p. 154, or Stahl's paper in *Ann. Buitenz.* 1893, reviewed in *Nat. Science*, 1893, and see article *Ficus*), noting at the same time the kind of climate from which each specimen has come. It will be easily seen that there is a good general correlation between the length of the tip and the wetness of the climate.

Large winter buds are formed, covered by scale leaves. In many species transitional forms will be seen as the bud elongates in spring, between the scales and the green leaves, showing that the scale is the equivalent, not of the whole leaf, but of the leaf base. In *Negundo*, often united to *Acer*, there are no scales, but the bud is protected by the base of the petiole of the leaf in whose axil it arises.

The flowers are in racemes, sometimes contracted to corymbs or umbels, are regular, polygamous, and not very conspicuous. The formula is usually  $K_5, C_5, A_4+4, G(2)$ . There is a well-marked disc. Apetaly occurs in some species. Three carpels are frequently met with, especially in the end flower of a raceme. The parts vary considerably in number, though all the whorls usually vary together in this respect. Honey is secreted by the disc and the ♂ flowers are protandrous, but the fertilisation methods and still more the sex-distributions and their causes, deserve further investigation.

There are 2 ovules in each carpel, orthotropous to nearly anatropous, with dorsal raphe. The resulting fruit is a schizocarp, each half of it containing as a rule one seed, and being provided with a wing, developed from the pericarp, by means of which it is blown about by the wind. The seed is exalbuminous and has the embryo (in the commoner species) usually curled up. In germination the

cotyledons come above the soil almost at once, and perform assimilatory duties.

*A. saccharinum* Wang. (and others) yield maple sugar, obtained by boring holes in the tree in February and March, and collecting the escaping juice.

The leaves of the maple commonly exhibit varnish-like smears, of sticky consistence, known as *honey-dew*. This is the excretion of the aphides which live on the leaves; the insect bores holes into the tissues, sucks their juices, and ejects a drop of honey-dew on an average once in half-an-hour. In passing under a tree infested with aphides, one may sometimes feel the drops falling like a fine rain (see *Pithecolobium*). The fluid is rich in sugar. When the dew falls the hygroscopic honey-dew, takes it up and spreads over the leaf; then later in the day evaporation reduces it to the state of a varnish on the leaf surface, which aids in checking transpiration. Many other trees exhibit this phenomenon, e.g. lime, beech, oak, &c. (see Büsgen, *Der Honigthau*, Jena: Fischer).

**Aceraceae.** Dicotyledons (Archichl. Sapindales). A small order with the characters of *Acer* (q. v.). The other genera are *Negundo* and *Dipteronia* (fruit winged all round). A. are placed in Sapindaceae by Bentham and Hooker, and in Aesculinæ by Warming.

**Aceranthus** Morr. et Dcne. Berberidaceae. 3 sp. Japan. United to *Epimedium* in *Nat. Pfl.*

**Aceras** R.Br. Orchidaceae (3). 1 sp. Eur. (incl. Brit.), *A. anthropophora* R.Br., the man-orchis. Like Orchis.

**Achillea** Linn. Compositae (VII). 80 sp. N. temp. *A. Millefolium* L., the yarrow or milfoil, is extremely common in Britain and *A. Ptarmica* L. is also frequent. The flowers have very short tubes and are visited by a less highly specialised group of insects than most of the order.

**Achimenes** P.Br. Gesneraceae (II). 25 sp. trop. Am.

**Achlamydosporeae.** The sixth cohort of Dicotyledons (Monochlamydeae) in the classification of Bentham and Hooker. See p. 145.

**Achlys** DC. Berberidaceae. 2 sp. Japan and Pacif. N. Am. The flowers have no perianth; it aborts early in development.

**Achras** Linn. Sapotaceae (I). Only sp. *A. Sapota* L., W. Indies, largely cultivated in the tropics for its edible fruit, the Sapodilla plum.

**Achyrachaena** Schau. Compositae (V). 1 sp. Calif. to Wash. State. The pappus is formed of broad silvery scales; the fruit-heads are used as "everlastings."

**Achyranthes** Linn. Amarantaceae (2). 15 sp. trop. and sub-trop.

**Actinache** Benth. Gramineae (VIII). 1 sp. trop. S. Am.

**Actianthus** R.Br. Orchidaceae (4). 7 sp. Austr., N. Z., New Caled. Eight pollinia.

**Acticarpa** Juss. Calyceraceae. 3 sp. temp. S. Am.

**Actineta** Lindl. Orchidaceae (19). 10 sp. Cent. Am., Mexico, epiphytic.

There is an outgrowth of the axis carrying out the labellum and 2 sepals. The labellum is attached to the column.

**Aciphylla** Forst. Umbelliferae (6). 13 sp. Austr., N. Z.

**Acokanthera** G. Don. Apocynaceae (1. 1). 3 sp. Abyss. and Cape Col. The root and wood of *A. venenata* G. Don supply the Zulus with their arrow-poison.

**Aconitum** Tourn. Ranunculaceae (2). 60 spec. N. temp. (*A. Napellus* L., the aconite or monkshood, in Brit.) The tuberous roots contain the alkaloid aconitin. The flowers are in racemes (see order). The posterior sepal forms a large hood, enclosing the two "petals" which are represented by nectaries on long stalks. The protandrous flower is thus adapted, by its structure and its blue colour, to bees. The distribution of *A.* is largely determined by that of the humble-bee (*Bombus*), the limit of the former being within, but close to, that of the latter, except in S. Am., where there are *Bombi* but no *A.* (See Drude, *Pflanzengeog.*) Humble-bees often rob the flower of its honey by biting through the hood. The fruit consists of follicles which only open so far as to expose the seeds, which escape when shaken by wind or otherwise.

The root of *A. ferox* Wall. furnishes the Bikh poison of Nepal. All sp. are poisonous; the root of the monkshood has sometimes been mistaken for horse-radish.

**Acorus** Linn. Araceae (1). 2 sp. *A. Calamus* L. is the chief sp. and is spread over the N. temp. zone (incl. Britain, where it is not endemic). Rhizome sympodial; leaves isobilateral (from this fact and the aromatic scent of all parts, comes the name 'sweet-flag'). Flrs. ♂, protogynous, with perianth.

**Acridocarpus** Guill. et Perr. Malpighiaceae. 11 sp. Afr.

**Acroclinium** A. Gray = *Helipterum* DC.

**Acrogamae** = *Porogamae*.

**Acroglochin** Schrad. Chenopodiaceae (A. 2). 1 sp. N. India, China.

The fruit mass is prickly, many of the twigs not ending in flrs.

**Acropera** Lindl. = *Gongora* Ruiz et Pav.

**Acrostichum** Linn. Polypodiaceae. About 150 sp. trop., mostly in wet places.

**Actaea** Linn. Ranunculaceae (2). 3 sp. N. temp. *A. spicata* L., the bane-berry or herb-christopher, occurs in Brit. The flrs. are in racemes and have only one cpl. Fruit a berry. *Cimicifuga* is sometimes united to *A.*, e.g. in *Nat. Pfl.*

**Actinella** Nutt. Compositae (vi). 17 sp. Am.

**Actinidia** Lindl. Dilleniaceae (Ternstroem. B. and H.). 8 sp. E. As.

**Actinopteris** Link. Polypodiaceae. 1 sp. Ind., Afr., Masc. It has the habit of a small palm with fan leaves.

**Actinolepis** DC. Compositae (vi). 9 sp. West U.S. Joined to *Baeria* in *Nat. Pfl.*

**Actinomeris** Nutt. Compositae (v). 2 sp. Atl. U.S.

- Actinostemma** Griff. Cucurbitaceae (1). 4 sp. Ind. to Japan.
- Actinostrobus** Miq. Coniferae (Arauc. 2 a; see C. for genus characters).  
1 sp. *A. pyramidalis* Miq., in S.W. Australia.
- Ada** Lindl. Orchidaceae (28). 1 sp. Colombia.
- Adamia** Wall. = *Dichroa* Lour.
- Adansonia** Linn. Bombacaceae. 3 sp. Afr., Austr. *A. digitata* L. is the Baobab, one of the largest trees known. Its height is not great, but it has a very stout trunk, as much as 30 ft. thick. The fruit is woody, containing a pulp in which lie the seeds.
- Adenandra** Willd. Rutaceae (IV). 25 sp. E. Afr.
- Adenanthera** Royen. Leguminosae (1. 4). 3 sp. trop. As. and Queensland. The seeds are hard and bright red (cf. *Abrus*).
- Adenia** Forsk. = *Modecca* Linn.
- Adenocarpus** DC. Leguminosae (III. 3). 10 sp. Medit.
- Adenophora** Fisch. Campanulaceae (1. 1). 10 sp. temp. Eur., As.
- Adenostemma** Forst. Compositae (II). 6 sp. trop. Am.
- Adenostoma** Hook. et Arn. Rosaceae (III. 7). 2 sp. Calif. *A. fasciculata* H. et A. is the shrub forming the "Chaparral" of the Sierras, so often mentioned in stories of adventure.
- Adenostyles** Cass. Compositae (II). 5 sp. Alpine, Eur., As. Minor. Also a synonym of *Zeuxine* (Orchidaceae).
- Adesmia** DC. (*Patagonium* Schrank.) Leguminosae (III. 7). 90 sp. S. Am.
- Adhatoda** Tourn. Acanthaceae (IV. B). 6 sp. trop.
- Adiantum** Linn. Polypodiaceae. About 70 sp., esp. trop. Am. *A. Capillus-veneris* L., the maiden-hair fern, occurs wild in a few spots in Brit. Many sp. of maiden-hair are favourite hot-house plants. Several tropical sp. are climbing epiphytes.
- Adinandra** Jack. Theaceae. 13 sp. trop. As., Afr.
- Adlumia** Rafin. Papaveraceae (III). 1 sp. E. N. Am. A leaf-climber.
- Adonis** Dill. Ranunculaceae (3). 20 sp. N. temp. *A. autumnalis* L., the pheasant's eye, is a rare cornfield weed in Britain.
- Adoxa** Linn. Adoxaceae. *A. moschatellina* L., the moschatel, is the only sp. It is found in the N. temp. zone, including Britain. There is a creeping monopodial rhizome, bearing a flowering shoot with a few radical leaves, a pair of opposite cauline leaves and a small head of greenish flowers, usually 5 in number (a condensed dichasial cyme). The terminal flower is usually 4-merous, the laterals 5-merous (cf. *Ruta* and other plants). Flowers  $\frac{5}{2}$ , regular, greenish and inconspicuous. There is a perianth of two whorls, the outer usually 3-merous; it is sometimes regarded as an involucre formed of bract and bracteoles, but is very probably a calyx. Sta. alternate with petals, divided almost to the base. Cpls. (3—5) rarely (2). Ovary semi-inferior with one pendulous ovule in each loculus. Fruit a drupe with several stones.
- Honey is secreted round the top of the ovary. The chief visitors are small flies, attracted by the curious musky smell.

**Adoxaceae.** Dicotyledons (Sympet. Rubiales). Only genus *Adoxa* (*g.v.*). Bentham and Hooker unite the order with the Caprifoliaceae, and other authors place it near to the Saxifragaceae. Its relationships to any order are not very close (see Schumann, *Morph. Studien*).

**Aechmea** Ruiz et Pav. Bromeliaceae (1). 50 sp. epiphytes, W. Ind. and S. Am.

**Aegiceras** Gaertn. Myrsinaceae (1v). 1 sp. *A. majus*, trop. Old World. It grows in mangrove swamps together with *Rhizophora*, &c., and exhibits a similar habit, vivipary, &c. (see p. 188).

**Aegilops** Linn. = *Triticum* L.

**Aegiphila** Jacq. Verbenaceae (1v). 30 sp. trop. Am.

**Aegle** Correa. Rutaceae (x). 2 sp. Indo-mal.

**Aegopodium** Knaut. Umbelliferae (5). 2 sp. Eur., As. (1 Brit.).

**Aegopogon** Beauv. Gramineae (111). 2 sp. Braz. to Calif.

**Aerides** Lour. Orchidaceae (31). 15 sp. E. As. Epiphytes; leaves fleshy.

**Aeschynanthus** Jack. (*Trichosporum* Don.) Gesneraceae (1). 70 sp. Indo-mal., China. Many are epiphytes with fleshy leaves. The flrs. show extreme protandry with movement of the sta. The seeds are provided with long hairs.

**Aeschynomene** Linn. Leguminosae (111. 7). 50 sp. trop. (*Herminiera* is often united with *A.*, *e.g.* in *Nat. Pfl.*)

**Aesculinae.** A cohort in Eichler's (Warming's) classification (p. 146).

**Aesculus** Linn. (including *Pavia* Poir. and *Billia* Peyr.) The only genus of Hippocastanaceae. 16 sp. N. temp. and Venezuela, &c. *A. Hippocastanum* L. is the horse-chestnut, which, with several sp. of the sub-genus *Pavia*, is commonly grown as an ornamental tree. *A. ohioensis* Michx. (= *glabra* Willd.) is the Buckeye of the U.S. They are trees with very large winter buds, covered with resinous scale leaves and containing the next year's shoot in a very advanced state (including the infl.). The bud expands very rapidly in spring. In *A. parviflora* Walt. transitions from scales to perfect leaves may be seen, showing the former to be the equivalent of leaf-bases. The leaves are opp. exstip. palmate; the blades when young hang downwards and are hairy. The infl. is mixed, the primary structure being racemose, but the lateral branches cymose (cincinni). The upper flowers are ♂, with rudimentary ovary, and open first. The ♀ flowers are protogynous, and when they open the ripe stigma protrudes whilst the sta. are bent down; later on these move up to a level with the style. Self-fert. may occur. The chief visitors are bees. On the corolla when young are yellow spots, which later on turn red (cf. *Fumaria*, *Diervilla*, &c.). The formula of the flr. is K (5); C 5 or 4 zygom.; A 8-5 introrse; disc extrastaminal, often one-sided.  $\bar{G}$  (3), 3-locular, with 2 ovules in each loc. Fruit a leathery capsule, usually one-seeded, 3-valved. Seed large exalbuminous. (Cf. this fruit with that of *Castanea*.)

**Aethionema** R.Br. (incl. *Eumonia* DC.). Cruciferae (11. 6). 50 sp. Medit.



Fruit lomentose in some sp.; in others, e.g. *A. heterocarpa* J. Gay, there are two kinds of fruit, one many-seeded and dehiscent, the other one-seeded indehiscent.

**Aethusa** Linn. Umbelliferae (6). 1 sp. *A. Cynapium* L. Brit. Eur. (fool's parsley).

**Afzella** Sm. (*Intsia* Thou.) Leguminosae (II. 3). 8 sp. trop. As. Afr.

**Agapanthus** L'Hérit. Liliaceae (IV). 3 sp. S. Afr. *A. umbellatus* L'H. is common in gardens. Infl. a cymose umbel. Seeds winged.

**Agapetes** G. Don. Ericaceae (III. 8). 30 sp. Nepal to Australia.

**Agathaea** Cass. = *Felicia* Cass. United to *Aster*.

**Agathis** Salisb. (*Dammara* Lam.) Coniferae (Arauc. 1a; see C. for genus characters). 4 sp. Malay to N. Z. Evergreen dioecious trees: the fruit takes two years to ripen. *A. Dammara* Rich. (*D. orientalis* Lamb.), in Malay and Phil. Is., yields Dammar, a resin largely used in varnish-making, &c. *A. australis* Steud. in Austr. and N. Z., is the Kauri or Cowrie pine, yielding a similar resin (Kauri-copal or dammar); the best pieces are dug out of the soil, often at a distance from any trees now living.

**Agathosma** Willd. Rutaceae (IV). 100 sp. S. Afr.

**Agave** Linn. Amaryllidaceae (II). 50 sp. trop. Am. The so-called Century plant or American Aloe (*A. americana* L.) is the most familiar sp. There is a short stem, which grows in thickness in a similar manner to the stem of *Yucca*, bearing a rosette of large fleshy leaves, coated on the surface with wax. Only two or three of these are formed in a year. During a period of from five to 100 or more years, depending on climate, the richness of the soil, &c. the plant is purely vegetative, and stores up in these leaves an enormous mass of reserve materials. At length it flowers, a gigantic terminal infl. coming rapidly out, sometimes reaching a height of 20 feet, and bearing many flowers. When the berries are ripe the reserves are exhausted, and the plant dies; it is thus an "annual" in a sense. The rush of sap to so large and so rapidly developed an inflorescence is of course very great; the Mexicans utilise it by cutting off the young flower head and collecting the sap (as much as 1000 litres have been got from one plant). The fermented juice is the national drink "pulque." The plant is also useful in many other ways, yielding fibre, &c. *A. rigida* Mill. yields the fibre "Sisal hemp," now largely used in rope making.

Vegetative reproduction occurs in two ways—by suckers from the base of the stem, and by bulbil-formation in place of some of the flowers (see p. 115).

**Ageratum** Linn. Compositae (II). 30 sp. trop., all but one Amer.

**Aggregatae** Engler. The 8th cohort of Dicot. Sympet. (see p. 140).

Ditto Eichler (Warming). The 10th cohort of Sympet. (see p. 147).

**Aglala** Lour. Meliaceae. 60 sp. Ind. to Austral.

- Aglaonema** Schott. Araceae (v). 10 sp. E. Ind. There are several infl. forming a sympodium. Flr. monœcious, naked.
- Agonis** Lindl. Myrtaceae (2). 13 sp. Austr.
- Agrimonia** Tourn. Rosaceae (III. 9). 10 sp. N. temp. *A. Eupatoria* L. and *A. odorata* Mill. (agrimony) in Brit. The recept. encloses the two achenes in frt. and is covered with hooks for animal carriage.
- Agropyron** J. Gaert. Gramineae (XII). 32 sp. temp. *A. caninum* Beauv. and *A. repens* Beauv. occur in Brit. The latter is the twitch or couch grass, a very troublesome weed in agriculture. It has a long rhizome, rooting at the nodes. If broken up by plough or harrow each node gives rise to a new plant, hence it is very hard to eradicate.
- Agrostemma** Linn. = *Lychnis* L.
- Agrostis** Linn. Gramineae (VIII). 100 sp. chiefly N. temp. 4 Brit. sp., including *A. alba* L. the white Bent- or Fiorin-grass, a valuable pasture grass with a creeping stem that roots at the nodes.
- Allanthus** Desf. Simarubaceae. 4 sp. Ind., Chi., Austr. *A. glandulosa* Desf., the tree of heaven, is a favourite in parks. Absciss layers are formed at the base of the leaflets as well as of the main petiole; the former usually drop first. Buds are formed on the roots (?).
- Ainsliaea** DC. Compositae (XII). 16 sp. Ind. to Japan.
- Ainsworthia** Boiss. = *Tordylium* L.
- Aira** Linn. Gramineae (IX). 11 sp. chiefly Eur., Afr. 2 sp. in Brit. (for *A. caespitosa* L. and *A. flexuosa* L. of Brit. flora, see Deschampsia, and for *A. canescens* L. see *Corynephorus*).
- Aizoaceae** (*Ficoideae* of Benth.-Hook.). Dicotyledons (Archichl. Centrospermae). 18 gen. with 420 sp. chiefly S. Afr. They are nearly allied to the other Centrospermae, but have been placed in various other relationships by other authors (near Cactaceae by B. and H.). Xerophytic herbs with opp. or alt. exstip. leaves, often fleshy, and with cymes of flowers. The anatomy is of interest (see *Nat. Pl.*). The typical formula, according to Pax, is  $P\ 5$  (odd leaf posterior);  $A\ 5$ ;  $\overline{G}\ (3)$ , 3-locular with  $\infty$  ovules in each. In the andrœceum, dédoublement is very common, and in these cases the outer sta. are frequently represented by petaloid staminodes (e.g. *Mesembryanthemum*). The ovary is usually sup. with axile plac. but in *M.* it is inf., multiloc. with parietal plac., a very unusual feature, brought about during development (see *M.*). Fruit usually a capsule; seed albuminous with curved embryo.
- *Classification and chief genera* (after Pax):
- I. **MOLLUGINOIDEAE** (perianth deeply 5-lobed: 'petals' or not: ov. sup.): *Mollugo*, *Orygia*.
  - II. **FICOIDEAE** (perianth tubular):
    1. *Sesuvieae* (ov. sup.; caps. with lid): *Sesuvium*, *Trianthema*.
    2. *Aizoeae* (do.; caps. splitting): *Galenia*, *Aizoon*.
    3. *Mesembryanthemeae* (ov. inf.): *Tetragonia*, *Mesembryanthemum*.

- Aizoon.** Aizoaceae (II. 2). 10 sp. Afr., Medit. Sta.  $\infty$  in bundles.
- Ajuga** Linn. Labiatae (I. 1). 30 sp. temp. *A. reptans* L. the bugle, and two others in Brit. The corolla has no upper lip, the sta. being protected by the bract above. Vegetative reproduction by runners.
- Akebia** Dcne. Lardizabalaceae. 2 sp. China, Japan. *A. quinata* Dcne. is often cultivated. Its flrs. are monœcious, the lower in the raceme usually ♀. The ♀ is much larger than the ♂, a very unusual thing. The berries dehisce like follicles.
- Alangium** Lam. Cornaceae. 4 sp. Malaya.
- Albizia** Durazz. Leguminosae (I. 1). 50 sp. trop. and sub-trop. Old World. *A. Lebbeck* Benth., and others, yield valuable timber.
- Albuca** Linn. Liliaceae (V). 30 sp. Afr. Outer sta. often staminodes.
- Alchemilla** Linn. Rosaceae (III. 9). 40 sp. temp. Flr. inconspicuous. with epicalyx, apetalous; sta. 2 or 4; cpls. 1—4, each with 1 ovule. Achenes enclosed in dry recept. *A. arvensis* Scop (parsley-piert), *A. vulgaris* L. (lady's mantle) and *A. alpina* L. occur in Brit. The last covers large areas in the Highlands; it has hairy leaves, more divided than those of the preceding sp., and the change from one type to the other is very noticeable in ascending the hills. The flrs. of all Brit. sp. are visited by flies.
- Alchornea** Sw. Euphorbiaceae (A. II. 2). 30 sp. trop. *A. (Coelebogyne) ilicifolia* Müll.-Arg. is only cultivated in the female form, but produces good seed. Adventitious embryos are formed by budding of the nucellus-tissue round the embryo-sac (cf. Funkia).
- Aldrovanda** Monti. Droseraceae. 1 sp. *A. vesiculosa* L. Eur., As. It is a rootless swimming plant, with whorls of leaves. Each of these has a stalk portion and at the end of this a few bristles and a blade like that of *Dionaea* (*q.v.*) provided with glands and trigger hairs. Mucilage is also secreted by stellate hairs on the leaf. Small water animals are captured and digested as in *Dionaea* (see Darwin, Goebel, &c. and p. 196). Winter buds (p. 170) are formed in colder climates.
- Aletris** Linn. Liliaceae (IX). 8 sp. E. As. and N. Am.
- Aleurites** Forst. Euphorbiaceae (A. II. 3). 5 sp. trop., sub-trop. Extrafloral nectaries occur on the petiole and at the ends of the large leaf-veins (see Groom, *Ann. of Bot.* 1894). The seeds yield an oil.
- Alfredia** Cass. Merged in *Carduus* Linn. (same spec. names).
- Alhagi** Tourn. Leguminosae (III. 7). 3 sp. Steppes and Medit. Thorny xerophytes. In the dry season the rootstock is blown about by the wind. A honey-like sap exudes from all sp. in hot weather, hardening into brownish lumps during the night (manna).
- Alibertia** A. Rich. Rubiaceae (I. 8). 20 sp. trop. Am.
- Alisma** Linn. (incl. *Caldesia* Parl.). Alismaceae. 6 sp. cosmop. *A. Plantago* L., the water-plantain, in Brit. Sta. 6, due to doubling of outer whorl, coherent at the base, forming a nectary. For *A. natans* L. see *Elisma*.
- Alismaceae.** Monocotyledons (Helobieae). 10 gen. with 50 sp. temp.

and trop. Mostly water or marsh herbs with perennial rhizomes. Leaves various, erect, floating, or submerged and exhibiting structure corresponding to their conditions of life (see p. 171 and *Sagittaria*, *Elisma*, &c.). In the leaf axils are small scales. Laticiferous vessels occur. Infl. usually much branched, the primary branching racemose, the secondary often cymose. Flr. ♂ or ♂ ♀, regular, with perianth of 6 leaves in two whorls, the outer sepaloid, the inner petaloid. Sta. 6-∞, with extrorse anthers. Cpls. 6-∞, apocarpous, superior, with 1 (rarely 2 or more) anatropous ovule in each. Fruit a group of achenes; seed exalbuminous; embryo horse-shoe shaped.

*Chief genera*: *Alisma*, *Elisma*, *Damasonium*, *Sagittaria*. [Benth.-Hook. unite *A.* with *Butomaceae*, placing them in *Apocarpae*.]

**Alkanna** Tausch. *Boraginaceae* (iv. 3). 30 sp. *Medit.* &c. The root of *A. tinctoria* L. furnishes the red dye, alkanet or alkannin.

**Allamanda** Linn. *Apocynaceae* (i. 1). 12 sp. *trop. Am.* and *W. Ind.*

**Alliaria** Marsh. = *Sisymbrium* L. (*A. offic.* DC. = *S. Alliaria* Scop.).

**Allionia** Loeffl. *Nyctaginaceae* (1). 1 sp. *Am.* *Anthocarp* glandular (cf. *Pisonia*).

**Allium** (Tourn.) Linn. *Liliaceae* (iv). About 250 sp. *N. temp.* *A. ursinum* L. (garlic), *A. Schoenoprasum* L. (chives), and 6 others, in *Brit.* *A. Cepa* L. (*Persia*, &c.) is the onion, *A. Porrum* L. (*Eur.*) the leek, *A. ascalonicum* L. (*Orient*) the shallot, *A. sativum* L. (*S. Eur.*) the garlic. All are bulbous herbs with linear (or hollow centric) leaves and cymose umbels of flrs. In many sp. the flrs. are replaced by bulbils serving for vegetative reproduction (cf. *Lilium*). In *A. ursinum*, &c. honey is secreted by the septal glands of the ovary; the protandrous flr. is visited by bees and flies.

**Alloplectus** Mart. (*Crantzia* Scop.) *Gesneraceae* (1). 35 sp. *trop. Am.*

**Allosorus** Bernh. = *Cryptogramme* R. Br.

**Almeidea** St. Hil. *Rutaceae* (v). 10 sp. *Brazil*.

**Alnus** (Tourn.) Linn. *Betulaceae*. 14 sp. *N. temp.* (*A. glutinosa* Medic., the alder, in *Britain*.) Like *Betula* in most features. In the axil of each bract of the ♂ catkin are 3 flowers (see diagram of the order, and cf. other genera) each with 4 stamens and 4 perianth leaves. The bracteoles α, β, β', β' are present. Stem.

(See diagram.) All these leaves are united with flr. flr. flr.

one another. In the ♀ catkin only two, the β' β' β'

lateral, flowers occur, and the same bracts. After α β

fertilisation, the ovary gives a one-seeded nut, bract.

under which is found a 5-lobed scale, the product of subsequent growth of the 5 leaves. The flower is chalazogamic (see p. 44 and art. *Chalazogamiae*).

**Alocasia** Neck. *Araceae* (vi). 20 sp. *E. Ind.* Herbaceous. Monocious. "*A. odora*, C. Koch, is supposed by Delpino to be fertilised by snails. The spadix is covered in its whole length with normal and abortive stamens and pistils; only ♀ flowers occur in the lower

wider part of the spathe, and they only are mature in the first period. From this chamber an attractive odour issues, and the snails are admitted by a narrow entrance. In the second stage this entrance closes and the anthers dehisce. Snails which creep on to flowers in this stage seek vainly for the entrance, and dust themselves with pollen, which they carry to the stigmas of younger plants" (Muller).

**Aloe** Tourn. Liliaceae (III). About 85 sp., mostly in Cape Colony, and especially on the dry Karroo desert. The plant is usually of shrubby or arborescent habit, the stem growing in thickness and branching. The leaves are borne in dense rosettes at the ends of the branches, and are usually very fleshy, with thick epidermis and sometimes a waxy surface. From them the drug is obtained; they are cut across and the juice collected and evaporated to the necessary stiffness.

**Alonsoa** Ruiz et Pav. Scrophulariaceae (II. 3). 6 sp. S. Am.

**Alopecurus** Linn. Gramineae (VIII). 20 sp. temp. *A. pratensis* L. (fox-tail, a valuable pasture grass) and 3 others in Brit. Flr. protogynous.

**Alphitonia** Reissek. Rhamnaceae. 6 sp. New Cal., Austr., Moluc

**Alphonsea** Hook. f. Anonaceae (I). 9 sp. trop. As.

**Alpinia** Linn. Zingiberaceae. 40 sp. trop. sub-trop. As., Austr., &c. The flr. has a small tubular calyx, a corolla with short tube and three large teeth, and a big labellum; the lateral staminodes are much reduced or wanting. Anther lobes divided by broad connective

**Alpine** Scop. = *Arenaria* Linn.

**Alsodeia** Thou. (*Rinorea* Aubl.) Violaceae: 40 sp. trop.

**Alsomitra** M. Roem. Cucurbitaceae (I). 11 sp. Indo-mal, Austr., S. Am.

**Alsophila** Br. Cyatheaceae. About 70 sp. trop. They are mostly large tree ferns with naked sori (the only genus of C. with no indusium). The pith of some sp. is eaten by natives of Australia, &c.

**Alstonia** R. Br. Apocynaceae (I. 3). 30 sp. E. As., Austr., Polynes. Leaves in whorls. The bark has tonic properties.

**Alstroemeria** Linn. Amaryllidaceae (III). 40 sp. esp. S. Am. The leaves are twisted at the base so that the true upper surfaces face downwards (the internal structure is also reversed) The capsule splits explosively.

**Alternanthera** Forsk. Amarantaceae (4). 20 sp. Am., Austr.

**Althaea** (Tourn.) Linn. Malvaceae (II). 15 sp. temp. Old World. *A. officinalis* L. (marsh mallow) and *A. hirsuta* L. occur in Brit. *A. rosea* Cav. is the holly-hock.

**Altingia** Noronha. Hamamelidaceae. 2 sp. China to Java. Like *Liquidambar*. The male flrs are reduced to naked sta, with basifixed anthers dehiscing laterally, so that only by comparison with related forms can it be shown that the spike of sta. is really an infl. and not a flr.

**Alyssum** Tourn. Cruciferae (IV. 17). 100 sp. Medit., Eur.

**Amanoa** Aubl. Euphorbiaceae (A. 1. 1). 6 sp. trop. Am., Afr.

**Amarantaceae.** Dicotyledons (Archichl. Centrospermae). An order so closely allied to Chenopodiaceae, that it seems scarcely just to separate them. They differ chiefly in habit, the Am. not as a rule being halo- or xero-phytes, and having larger leaves, rarely succulent. The flrs. are in cymes in the axils of the leaves, so that the total infl. is generally racemose. The typical diagram is the same as that of the C. Perianth membranous. [For details, see *Nat. Pfl.*]

*Classification and chief genera* (after Schinz):

A. **AMARANTOIDEAE** (anther 4-locular).

1. *Celosiaceae* (ovules > 1): Celosia.

2. *Amaranteae* (ovule 1): Amaranthus.

B. **GOMPHRENOIDEAE** (anther 2-locular).

3. *Guillemineae* (sta. perigynous): Guilleminea.

4. *Gomphreneae* (sta. hypogynous): Gomphrena, Iresine.

**Amaranthus** Linn. Amarantaceae (2). 45 sp. trop. and temp. ("love-lies-bleeding"). The infl. is often made up of an enormous number of flrs., is very conspicuous, and probably insect-fertilised.

**Amaryllidaceae.** Monocotyledons (Liliiflorae). 75 gen. with about 700 sp. mostly trop. and sub-trop. They resemble Liliaceae in most respects but have an inferior ovary. Living, as they chiefly do, in dry climates, they are mostly xerophytes. Many are bulbous, leafing only in the wet season, others, e.g. Agave, &c., have fleshy leaves covered with wax. A few (§ III) have ordinary leafy stems; many have rhizomes. The infl. is usually borne on a scape and has the usual spathe seen in Monocotyledons. It is always cymose, but often umbel- or head-like in form by condensation of the flrs. Flr. ♂, regular or zygomorphic (transversely so in Anigozanthos). It has an inf. ovary of 3 cpls. with axile placentae and ∞ anatropous ovules, 6 sta. with introrse anthers, 6 petaloid perianth-segments, and in some cases (Narcissus and its allies) a corona, looking like an extra perianth whorl, between the normal perianth and the sta. Eichler looks on this as the combined ligular outgrowths of the perianth leaves, Pax (*Morphologie* p. 227 or *Nat. Pfl.*) as the stipules of the sta., giving a series of flrs. showing transitions from simple stipular outgrowths on each sta. to a full corona (Caliphuria, Sprekelia, Eucharis, Narcissus). The fruit is usually a capsule, sometimes a berry. [Placed in Epigynae by Benth.-Hooker.]

• *Classification and chief genera* (after Pax):

I. **AMARYLLIDOIDEAE** (bulbous, scapigerous): Haemanthus, Galanthus, Amaryllis, Crinum, Eucharis, Narcissus.

II. **AGAVOIDEAE** (rhizome; leaves fleshy, in rosettes): Agave, Fourcroya.

III. **HYPOXIDOIDEAE** (rhizome; stem with small ordinary leaves): Alstroemeria, Bomarea, Anigozanthos.

IV. **CAMPYNEMATOIDEAE** (anthers extrorse): Campynema.

- Amaryllis** Linn. Amaryllidaceae (I). 1 sp. *A. belladonna* L., Cape Colony. The flr. is rendered zygomorphic by the upward curve of the sta.; the style projects above the anthers, favouring cross-pollination.
- Amasonia** Linn. Verbenaceae (II). 6 sp. trop. Am.
- Ambora** Juss. = Tambourissa Sonn.
- Ambrosia** Linn. Compositae (V). 15 sp., 1 Medit., 14 Am. Heads unisexual, the ♀ one-flowered. Fruit enclosed in the involucre.
- Ambrosinia** Linn. Araceae (VII). 1 sp. Medit.
- Amelanchier** Medic. Rosaceae (II. 4). 10 sp. N. temp.
- Amellus** Linn. Compositae (III). 9 sp. S. Afr.
- Amentaceae** = orders in cohorts 2, 3, 4, of Archichlamydeae.
- Amethystea** Linn. Labiatae (I. 1). 1 sp. Siberia.
- Amherstia** Wall. Leguminosae (II. 3). 1 sp., *A. nobilis* Wall. (India), remarkable for its splendid flrs. Stalk and bracts as well as petals are bright red. Sta. united in a tube.
- Amianthium** A. Gray = *Zygadenus* Michx.
- Amicta** H. B. et K. Leguminosae (III. 7). 5 sp. Andes. In *A. Zygo-*  
*meris* DC. the big stipules protect the bud.
- Ammannia** (Houst.) Linn. Lythraceae. 18 sp., wet places, cosmop.
- Ammi** (Tourn.) Linn. Umbelliferae (5). 6 sp. Old World.
- Ammobium** R. Br. Compositae (IV). 2 sp. New S. Wales. *A. alatum* R. Br. is often cultivated for its flower-heads, which, when dried, form one of the many "everlastings."
- Ammophila** Host. Gramineae (VIII). 1 sp. N. temp. (incl. Brit.), *A. (Pennisetum) arundinacea* Host., common on sandy coasts (marram grass). It is largely used to bind sand dunes, possessing a long rhizome. After some years a light soil is formed in which fescue and other plants take root, and gradually the whole is covered with vegetation. The leaves curl up inwards in dry air, thus avoiding transpiration (see order). [See p. 188.]
- Amomum** Linn. Zingiberaceae. 50 sp. trop. As., Afr., Austr., Polynes. The leafy stems rarely bear flrs.; these are borne on other axes springing directly from the rhizome. Many sp. furnish forms of Cardamoms. See Elettaria.
- Amorpha** Linn. Leguminosae (III. 6). 10 sp. N. Am. *A. fruticosa* L. is common in shrubberies. The small flrs. are arranged in a dense spike. Wings and keel are absent, the standard only remaining; it folds round the stamen-tube at the base. The flr. is ♂ protogynous with persistent stigma
- Amorphophallus** Blume. Araceae (IV). 15 sp. E. Ind. There is a corm-like rhizome, giving rise yearly to one enormous leaf (in some sp. the stalk 15 feet long and the leaf 10 feet across) and an equally gigantic infl. (in *A. Titanum* Becc. 3 feet high) with ♂ flrs. above and ♀ below. Its dirty red and yellow colour, and foetid smell, attract numbers of carrion flies by which it

is fertilised; they are often so deceived as to lay their eggs on the spadix.

**Ampelidaceae** (or Ampelideae) = Vitaceae.

**Ampelodesma** Beauv. Gramineae (x). 3 sp. Medit. and Afr. The leaves of *A. tenax* Link. (Algiers) are used like Esparto (Stipa).

**Ampelopsis** (Rich. in) Michx. = Vitis Linn. (*A. hederacea* DC. = V. hed.; *A. quinquefolia* Michx. = V. hed.; *A. Viticifolia* Hort. = V. inconstans).

**Amphicarpaea** Ell. Leguminosae (III. 10). 15 sp. trop. and temp. N. Am., Japan, Himalaya. *A. monoica* Ell. and others have cleistogamic fls. below, which give subterranean fruits like Arachis.

**Amphicome** Royle. Bignoniaceae (II). 2 sp. Himal.

**Amsinckia** Lehm. Boraginaceae (IV. 2). 8 sp. W. Am.

**Amsonia** Walt. Apocynaceae (I. 3). 7 sp. N. Am., Japan.

**Amygdalus** (Tourn.) Linn. = Prunus Tourn. (*A. communis* L. = P. Amygd. *A. Persica* L. = P. Pers.)

**Amyris** P.Br. Rutaceae (IX). 12 sp. trop. Am.

**Anabasis** Linn. Chenopodiaceae (10). 17 sp. Medit., As.

**Anacampseros**. Portulacaceae. 9 sp. S. Afr. Xerophytes with fleshy leaves; stipules represented by bundles of hairs protecting the young leaves in the bud.

**Anacamptis** Rich. = Orchis Linn.

**Anacardiaceae**. Dicotyledons (Archichl. Sapindales). 59 gen. with 500 sp., chiefly found in the tropics, but occurring also in the Medit., Chino-Jap., N. Amer., and Andine regions. In habit they resemble plants of other families, e.g. Rutaceae, Leguminosae, Sapindaceae, &c., but their floral characters mark them off as a distinct order. They are trees or shrubs with alt. exstip. leaves and panicles of fls. Resin-passages occur, but the leaves are not gland-dotted (hence they cannot be confounded with Rutaceae).

The receptacle may be convex, flat or concave, and a gynophore or other axial outgrowth may occur. The flr. is typically 5-merous, but usually with reduction in the essential organs. The sta. are generally less than 10, the cpls. most commonly 3, rarely (3). Very often only one of the three is fertile, and frequently only one cpl. is found at all. Ovule solitary, anatropous with dorsal raphe. Fruit various. Endosperm. [Placed in Sapindales by B.-H.]

*Classification and chief genera* (after Engler):

A. 5 free cpls. or 1. Leaf simple, entire:

I. **MANGIFEREAE**: Mangifera, Anacardium.

B. Cpls. united. Lf. rarely simple:

II. **SPONDIACEAE** (ovules in each cpl.): Spondias.

III. **RHOIDEAE** (one ovule only, ovary free): Pistacia, Rhus.

IV. **SEMECARPEAE** (do., ovary sunk in axis): Semecarpus.

C. Cpl. 1. ♀ flr. naked. Lf. simple, toothed:

V. **DOBINEAE**: Dobinea (only genus).



**Anacardium** Linn. Anacardiaceae (1). 8 sp. trop. Am. *A. occidentale* L. is the Cashew-nut, largely cultivated. Its stem yields a gum. The flrs. are polygamous. Each has one cpl. which yields a kidney-shaped nut with a hard testa containing a black acrid juice. The nut is edible if the testa be carefully removed. Under it the axis of the flr. swells up into a large pear-like body, fleshy and edible, and so the seeds are distributed by animal agency.

**Anacharis** Rich. = *Elodea* Michx.

**Anacyclus** Linn. Compositae (VII). 12 sp. Medit.

**Anagallis** (Tourn.) Linn. Primulaceae (III). 12 sp. Eur., As., Afr., S. Am. 2 sp. in Brit., the pimpernels. *A. arvensis* L. is often called 'poor man's weather-glass,' because the flrs. close in dull or cold weather.

**Anagyris** Linn. Leguminosae (III. 2). 2 sp. Medit.

**Anamirta** Colebr. Menispermaceae. 7 sp. Malayan region. The achenes of *A. Cocculus* Wight et Arn. are known as "Cocculus indicus" and are sometimes used to adulterate porter, &c. though they contain an irritant poison. In the angles between the big veins of the leaves are acaro-domatia covered with hairs (see p. 117).

**Ananas** Tourn. Bromeliaceae (1). 6 sp. trop. Am.; of these the best known is *A. sativus* Schult., the Pine-apple. The stem is short (terrestrial) and leafy, bearing a terminal infl. of a mass of flrs. in the axils of bracts. These, together with the axis and the fruits, form a general fleshy mass after fertilisation, and the main axis usually goes on beyond it and produces more green leaves—the 'crown' of the pine-apple. Seeds are rarely formed. [See *Treas. of Bot.*]

**Anaphalis** DC. Compositae (IV). 30 sp. Eur., As.

**Anastatica** Linn. Cruciferae (IV. 18). 1 sp., *A. hierochuntina* L., the Rose of Jericho. This plant inhabits the regions from Syria to Algeria, where a long dry season occurs every year. While the seeds are ripening the leaves fall off and the branches fold inwards until the whole is reduced to a dry ball of wicker-work. In this state it is easily loosened from the dry ground and it *may* be blown bodily along by the wind, the fruits remaining closed. If it be driven into water or on to wet soil, or in any case when the wet season comes on, the hygroscopic nature of the twigs causes their unfolding, and at the same time the capsules open and shed their seeds. [See pp. 110, 182.]

**Anaxagorea** St Hil. Anonaceae (3). 20 sp. trop. As., Am.

**Anchusa** Linn. Boraginaceae (IV. 3). 40 sp. Old World. *A. officinalis* L. was formerly officinal and is widely scattered, occurring as an escape in Brit.

**Ancistrocladaceae**. Dicotyledons (Archichl. Parietales). Only genus *Ancistrocladus* (q.v.). The order is united with Dipterocarpaceae by Bentham and Hooker, but separated by Gilg (in *Nat. Pfl.* 1894), on the ground of the 1-locular ovary, endosperm, &c.

- Ancistrocladus** Wall. *Ancistrocladaceae*. 8 sp. trop. Afr., As. They are lianes, with sympodial stem-structure, each member ending in a tendril of a watch-spring pattern. Leaves alt., lanceolate, entire, with minute stipules. Racemose infl. of ♂ regular flowers.  $K_5$  with unequal teeth;  $C(5)$  very slightly united, convolute;  $A_5$  or 10.  $\bar{G}$ , 1-locular, with 1 basal erect semi-anat. ovule. Nut. Endosperm.
- Andira** Lam. (*Vouacapoua* Lam.) *Leguminosae* (III. 8). 20 sp. trop. Am. *A. inermis* H. B. et K. is one of the 'rain-trees' (see *Pithecolobium*).
- Andrachne** Linn. *Euphorbiaceae* (A. I. 1). 8 sp. *Medit.*, China, Cape Col., Am.
- Andromeda** Linn. *Ericaceae* (II. 4). 6 sp. boreal. *A. polifolia* L. in peat bogs in Brit.
- Andropogon** Linn. *Gramineae* (II). 180 sp. cosmop. *A. Schoenanthus* L. the lemon grass (trop. As. Afr.) and *A. Nardus* L. (trop.) yield, by distillation, lemon-oil and citronella-oil respectively. Both are largely used in perfumery. *A. squarrosus* Linn. f. (*A. muricatus* Retz.) is the Khus-Khus of India, whose roots are woven into the fragrant 'tatties' or fans. The scent of these is given off when they are sprinkled with water. [*A. Sorghum* Brot. = *S. vulgare* Pers.]
- Androsaemum** Tourn. = *Hypericum* Linn.
- Andryala** Linn. *Compositae* (XIII). 12 sp. *Medit.*
- Anellema** R. Br. *Commelinaceae*. 60 sp. trop.
- Anelmia** Sw. *Schizaeaceae*. About 30 sp. trop. Am. The leaf divides at the base, in a way which has been compared with the behaviour of the fronds of *Ophioglossaceae*, into a sterile and a fertile portion. The two lowest pinnae form a pair of panicles bearing sori (cf. *Osmunda*).
- Anemone** Linn. *Ranunculaceae* (3). 90 sp. N. and S. temp. *A. nemorosa* L., the wood anemone, and *A. Pulsatilla* L., the Pasque flower, occur in Brit. Herbs with rhizomes and 'radical' leaves. Flrs. solitary or in cymes, apetalous; under each is an involucre of green leaves, which in the common *Hepatica* (*A. Hepatica* L.) is so close to the flr. as to resemble a calyx. The flr. of the first named sp. contains no honey, is white, and visited for pollen by insects of low type; that of the third is blue and bee-visited, whilst in *Pulsatilla* there is honey secreted by staminodes and the long-tubed blue flr. is visited almost solely by bees. The achenes of many sp. are covered with hairs aiding wind-distribution.
- Anemonopsis** Sieb. et Zucc. *Ranunculaceae* (2). 1 sp. Japan.
- Anemopaegma** Mart. *Bignoniaceae* (1). 25 sp. Braz.
- Anethum** Tourn. = *Peucedanum* L.
- Angelica** (Riv.) Linn. *Umbelliferae* (6). 20 sp. N. temp. and New Zeal. (see p. 158). *A. silvestris* L. in Brit. For the garden sp. see *Archangelica*.
- Angianthus** Wendl. *Compositae* (IV). 22 sp. temp. Austr. The

heads are united into dense spikes or even into compound heads (cf. Echinops).

**Angiopteris** Hoffm. Marattiaceae (1). 1 sp., *A. evecta* Hoffm., trop. Asia, &c. Large ferns with the sori not united into synangia as in the rest of the order. There is an annulus like that of Osmundaceae at the apex of the sporangium.

**Angiospermae.** One of the two great divisions of Phanerogams or Spermatophytes. They are distinguished from the Gymnosperms by the fact that the carpels are invariably so infolded or arranged as to form an ovary in which the ovules are borne. Further, the endosperm (female prothallus) is not formed until after fertilisation, instead of before it as in G.

We have dealt so fully with the morphology of A. in Part I of the book that there is no need for much repetition here. All A. possess true flowers, the essential parts of which are stamens and carpels. The former bear pollen sacs, equivalent to micro-sporangia of Pteridophyta (*q.v.*), the latter ovules (=mega-sporangia). [See Gymnosperms.] The pollen, in structure and development, resembles both the microspores of Pterid. and the pollen of G. very closely; but in the carpels we find important differences. The ovule is always enclosed in the carpel; it has 2 integuments (or 1) and in the nucellus we find as a rule one embryo-sac (more in some Chalazogams, Loran-thaceae, &c.), in which is one ovum, at the upper (micropylar) end, not enclosed in an archegonium. On either side of it is another naked cell; these two are usually regarded as abortive ova (*synergidae*). At the other end of the embryo-sac are 3 cells (*antipodal cells*), supposed to represent another *egg-apparatus* (the name often given to the ovum and synergidae) which is now entirely abortive. In the centre of the sac is a large nucleus. After fertilisation occurs, this gives rise to a mass of endosperm filling the sac.

Recently, observations have been made tending to show that certain A. differ very much from the rest in the ovular structure and the mode of fertilisation (see p. 44 and art. *Chalazogamiae*), and it is possible that the group will have to be divided into two, one of which will come nearer to Gymnospermae than the other.

A. are divided into Monocotyledons and Dicotyledons (*q.v.*, and see Chapter II). For further details see Part I, and articles *Cryptogamiae*, *Pteridophyta*, *Phanerogamiae*, *Gymnospermae*, *Chalazogamiae*, where further references will be found.

**Angraecum** Bory (incl. *Macroplectrum* Pfitz.). Orchidaceae (31). About 25 sp. trop. Afr., Madag. &c. Epiphytes; monopodial. The most interesting sp. is *A. sesquipedale* Thou., the wax-flower. At the base of the labellum is an enormous spur, 12 to 14 inches long, at the bottom of which the honey is secreted. As Darwin observed (*Orchids*, p. 162, *q.v.*), this flr. must have a corresponding large insect, with a tongue of the same length, as its fertiliser. This

idea was ridiculed at the time, but the moth has since been discovered. The flr. and moth afford an interesting example of mutual adaptation (cf. *Yucca*, *Ficus*, &c.).

**Anguloa** Ruiz et Pav. Orchidaceae (18). 3 sp. Andes; epiphytic.

**Anguria** (Tourn.) Linn. Cucurbitaceae (11). 17 sp. trop. Am.

**Anhalonium** Lem. = *Mammillaria* Haw. (same spec. names). *A. Williamsii* Lem. = *Echinocactus* Will.

**Anigozanthos** Labill. Amaryllidaceae (111). 10 sp. Austr. The flr. is transversely zygomorphic. [Haemodoraceae Benth.-Hook.]

**Anisodus** Link et Otto. = *Scopola* Jacq.

**Anoda** Cav. Malvaceae (11). About 16 sp. trop. Am.

**Anoetochilus** Blume. Orchidaceae (4). 8 sp. Indo-mal.

**Anoiganthus** Baker. Amaryllidaceae (1). 1 sp. Natal.

**Anomatheca** Ker-Gawl. = *Lapeirousia* Pourr. (same spec. names).

**Anona** Linn. Anonaceae (6). 60 sp. trop. Am., Afr. The fruit is compound, being made up of the individual fruits (berries) derived from the separate cpls., sunk in, and united with, the fleshy receptacle; it is often very large. That of some sp. is edible, e.g. of *A. Cherimolia* Mill. (Cherimoyer; trop. Am.), *A. squamosa* L. (sweet sop or sugar apple; E. Ind.), *A. muricata* L. (sour sop; trop. Am.) and *A. reticulata* L. (custard-apple or bullock's heart; trop. Am.). All these are frequently cultivated in the Tropics.

*A. rhizantha* Eichl. gives off, near the ground, shoots which creep as rhizomes below the soil, bearing scale leaves only. The flrs. are borne on branches of these which come above the ground.

**Anonaceae.** Dicotyledons (Archichl. Ranales). 46 gen. 620 sp. chiefly trop. (esp. Old World). Trees and shrubs (exc. one sp.) with usually two-ranked undivided exstip. leaves. The stem is sometimes sympodial, at least in the infl. Oil passages are present.

Flrs. regular, ♂ (rarely unisex.), solitary or in infl. of various types. The usual formula is  $P\ 3+3+3$  (one or two outer whorls sepaloid);  $A\ \infty$  (rarely few), spiral, hypogynous;  $\underline{G}\ \infty$  (exc. *Monodora*). Ovules usually  $\infty$ , ventral or basal, anatropous. Fruit commonly an aggregate of berries; where these are many-seeded they are frequently constricted between the seeds. In *Anona*, &c. the berries coalesce with the receptacle. Seeds with ruminant endosperm (the chief character that separates A. from Magnoliaceae). Many sp. yield valuable edible fruits, e.g. *Anona*, *Artabotrys*.

• *Classification and chief genera* (after Prantl): •

A. Perianth present; flr. hypogynous.

a. Apocarpous.

1. *Miliuseae* (sta. not broadened above anther): *Miliusa*.

2. *Uvarieae* (sta. broadened above anther; corolla imbricate):  
*Uvaria*, *Asimina*, *Guatteria*.

3. *Unoneae* (ditto but valvate; pets. usually spreading):  
*Unona*.

*Melodoreae* (as 3, but pets. erect, touching at edges): Oxy-mitra, Melodorum.

5. *Mitrephoreae* (as 3, but inner pets. stalked): Mitrephora.

6. *Xylopieae* (as 3, but pets. hollow at base, and constricted above it): Xylopia, Artabotrys, Anona.

b. Syncarpous; ov. uniloc. with parietal plac.

7. *Monodoreae*: Monodora (only genus).

B. No perianth; fr. perigynous.

8. *Eupomatieae*: Eupomatia (only genus).

[Placed in Ranales by Benth.-Hook., in Polycarpiceae by Warming.]

**Anopterus** Labill. Saxifragaceae (v). 2 sp. Austr., Tasm.

**Ansellia** Lindl. Orchidaceae (9). 4 sp. trop. Afr.

**Antennaria** Gaertn. Compositae (iv). 15 sp. extra-trop., exc. Afr.

*A. dioica* Gaertn. (mountain everlasting or cat's ear) occurs in Brit.

It is a small creeping dioecious perennial, hairy and semi-xerophytic.

It is found chiefly on hills and at the sea-shore, but is not common in intermediate places (p. 189).

**Anthemis** Mich. Compositae (vii). 100 sp. Eur., Medit. (4 in Brit.—chamomile). The frt. of *A. arvensis* L. has papillae on its upper surface which swell up and become sticky when wetted (see Linum).

**Anthericum** Linn. Liliaceae (iii). 60 sp. Afr., Eur., Am.

**Antholyza** Linn. Iridaceae (iii). 20 sp. Afr.

**Anthostema** A. Juss. Euphorbiaceae (A. II. 8). 3 sp. trop. Afr. The fls. are in a cyathium like that of Euphorbia, but the ♂, reduced as in E. to a single sta., has a perianth at the place where in E. there is only a joint. (See E.) The ♀ also has a perianth.

**Anthoxanthum** Linn. Gramineae (vi). 4 sp. N. temp. and Ind.; the chief is *A. odoratum* L., the sweet vernal grass of Britain, common in pastures. It is a matter of dispute as to whether it is a valuable pasture grass or not. The stems contain large quantities of coumarin, to which the smell (so characteristic of newly mown hay) is due; it may be easily recognized by chewing a stalk. Flr. with 2 sta. only, protogynous. The awns of the fruit are hygroscopic.

**Anthriscus** Bernh. Umbelliferae (5). 10 sp. Eur., As., Afr., 2 in Brit.; *A. sylvestris* Hoffm. (chervil) is one of the commonest weeds.

**Anthurium** Schott. Araceae (i). 200 sp. trop. Am. Most are sympodial herbs, with an accessory bud always formed beside the 'continuation' bud of the sympodium. The axillary shoot is often 'adnate' to the main one for some distance (cf. Solanaceae &c.). Aerial roots are frequently formed at the base of the leaves. Some sp. live as epiphytes. The fls. are ♀, with perianth, arranged in a dense mass upon a spadix, at whose base is a flat usually brightly coloured spathe. The fr. is protogynous, and visited by insects. The fruit is a berry and when ripe is forced out of the spadix and hangs by two threads formed from the perianth, so that it is easily obtained by

- birds, and thus distributed. In *A. longifolium* G. Don the root apex has been observed to develop into a shoot (Goebel; see p. 20).
- Anthyllis** Riv. Leguminosae (III. 4). 20 sp. Eur., N. Afr., W. Asia. (*A. vulneraria* L., lady's fingers or kidney-vetch, in Brit.). The floral mechanism resembles that of *Lotus*; the stigma only becomes receptive when rubbed.
- Antiaris** Lesch. Moraceae (II). 5 sp. E. Ind. *A. toxicaria* Lesch. is the famous Upas-tree of Java. The latex contains a virulent poison. Extraordinary stories of the effects of this were spread abroad about a century ago. The surroundings of the tree, within a radius of several miles, were said to be a total desert, the poisonous influence emanating from the tree being fatal to all other forms of life. The noxious volcanic valleys, containing quantities of carbon dioxide, are probably responsible for the origin of these legends (see *Treas. of Bot.*).
- Anticlea** Kunth. = *Zygadenus* Michx. (same spec. names).
- Antidesma** Burm. Euphorbiaceae (A. I. 1). 70 sp. Old World trop.
- Antigonon** Endl. Polygonaceae (III. 5). 4 sp. trop. Am. *A. leptopus* Hook. et Arn. is a (stem) tendril climber.
- Antirrhinum** Tourn. Scrophulariaceae (II. 5). 32 sp. N. Hemisph. *A. majus* L. the snapdragon, is found wild in some parts of Brit., but is probably an escape from cultivation. The mouth of the flr. is closed and the honey is thus preserved for bees, which alone are strong enough to force an entrance.
- Anychia** Michx. Caryophyllaceae (II. 4). 2 sp. N. Am.
- Aotus** Sm. Leguminosae (III. 2). 11 sp. Austr., Tasm.
- Apera** Adans. Gramineae (VIII). 2 sp. Eur., W. As. *A. (Agrostis) Spica-Venti*, Beauv., the silky bent-grass, in Brit.
- Apetalae** = Monochlamydeae or Incompletae (see p. 144).
- Aphelandra** R. Br. Acanthaceae (IV. B). 60 sp. trop. Am. Several are cultivated for their showy flrs. and coloured bracts.
- Aphyllanthes** Tourn. Liliaceae (III). 1 sp. Medit., *A. monspeliensis* L. The solitary flr. is surrounded by an involucre of bracts, and is regarded as the only remaining flr. of a head; the other flrs. are only represented by their bracts (Engler).
- Apicra** Willd. Liliaceae (III). 7 sp. S. Afr. Xerophytes, nearly related to Aloe and Gasteria. Some, e.g. *A. foliolosa* Willd., show an extreme superposition of leaves, and form almost solid masses of fleshy tissue, biologically though not morphologically equivalent to a cactus.
- Apios** Moench. Leguminosae (III. 10). 5 sp. N. Am., China. *A. tuberosa* Moench. is a favourite climber, a perennial with tuberous base to the stem. The flowers are peculiar, the keel forming a tube which bends up and rests against a depression in the standard. When liberated by insects or otherwise the tension of the keel makes it spring downwards, coiling up more closely. This causes the essential organs to emerge at its apex.
- Apium** (Tourn.) Linn. (incl. *Helosciadium* Koch). Umbelliferae (5).

14 sp. cosmop. 3 in Brit. of which *A. graveolens* L., found in marshy places near the coast, is the celery. The wild plant is poisonous, but cultivation and the blanching (etiolation) of the leafstalks by heaping earth over them, renders the garden form innocuous. The two other sp. are common in ditches.

**Aplopappus** Cass. (*Haplopappus* Endl.). Compositae (III). 100 sp. W. Am.

**Apocarpae** (Benth.-Hooker). The 6th series of Monocotyledons (p. 145).

**Apocynaceae**. Dicotyledons (Symptet. Contortae). 130 gen. and abt. 1000 sp., mostly trop. A few are temp.; *Vinca minor* gives the N. limit in Eur. Erect plants are rare, the order consisting mainly of twining shrubs; in the tropics many grow to large lianes. The stem has bi-collateral bundles; latex is always present. The leaves are simple, usually opp., entire, rarely with small interpetiolar stipules. The primary type of infl. is a panicle, but in its later branchings it sometimes goes over into a dichasial cyme or a cincinnus. Bracts and bracteoles are both present.

Flr. ♂, regular, 5- or 4-merous. K (5), deeply lobed, quin-cuncial with odd sepal posterior; C (5), usually salver- or funnel-shaped, often hairy within, convolute (valvate in a few rare gen.); A 5, alternate with pets., epipetalous, with short included filaments; anther lobes full of pollen to the base, or empty at base and prolonged into rigid spines. Disc usually present. Cpls. (2) or 2 (united by style) or more, superior, 1- or 2-locular when syncarpous. Ovules ∞, anatropous, pendulous. Style usually simple with thickened head. Fruit a berry, or more often 2 follicles. Seeds usually flat and often with a crown of hairs serving for wind distribution. Endosperm or none; embryo straight.

In the common *A.* with a large stylar head the stigma is at the edge or under surface of the head and self-fertilisation is almost impossible. A very interesting mechanism is found in *Apocynum androsaemifolium*.

*Classification and chief genera* (after K. Schumann):

- I. **PLUMIEROIDEAE** (sta. free or only loosely joined to stylar head; thecae full of pollen, rarely with spines; seeds usually without hairs):
  1. *Arduineae* (syncarpous; style not split at base): Arduina, Allamanda, Landolphia.
  2. *Pleiocarpeae* (apocarpous; style split at base; more than 2 cpls.): Pleiocarpa.
  3. *Plumiereae* (ditto; 2 cpls.): Plumiera, Amsonia, Vinca, Tabernaemontana, Cerbera.
- II. **ECHITOIDEAE** (sta. firmly joined to stylar head; thecae empty at base, and with spines; seeds hairy):
  4. *Echitideae* (anthers included): Apocynum, Nerium, Strophanthus, Dipladenia.

5. *Parsonsiae* (anthers excluded): *Parsonsia*, Lyonsia.

[Placed in Gentianales by B. and H.; Contortae by Warming.]

**Apocynum** (Tourn.) Linn. Apocynaceae (11. 4). 3 sp. Eur., As., N. Am. Of these the most interesting is *A. androsaemifolium* L., a shrub often found in gardens under the name "American fly-trap," given to it because large numbers of flies are caught by the flrs. The mechanism resembles that of Asclepiadaceae. The ovary is crowned by a disc, stigmatic on the lower side and surrounded by the rigid lignified stamens. Honey is secreted at the base of the stamens and an insect in withdrawing its proboscis usually brings it up the narrow slit between two stamens. At the base of this is a drop of cement and higher up the anthers dehisce laterally; thus the insect withdraws the pollen on its proboscis, but considerable strength is required and small insects are usually held fast. On a second visit the pollen is scraped off upon the stigmatic surface. The seeds are crowned with hairs for wind carriage.

**Aponogeton** Linn. f. Aponogetonaceae. 15 sp. Afr., Madag., As., Austr. Water-plants with sympodial tuberous rhizomes. Leaves usually floating, but submerged ones occur in some sp., e.g. *A. (Ouvurandra) fenestrata* Hook. f. Here the whole tissue of the leaf between the veins breaks up as the leaf grows, leaving a network of veins with holes between them. Close round the veins is a little green tissue serving assimilatory purposes. The interior tissue does not contain the intercellular spaces characteristic of most water-plants, and Goebel (*Pflanzenbiol. Schild.* 11. p. 319) suggests that this is because the holes in the leaf render all parts of it easily accessible to the water with its dissolved gases. Young leaves in the bud show no trace of this phenomenon. [See p. 171.]

The flrs. project above the water, and are arranged in spikes; the spathe is early thrown off. Some sp. have a perianth of 3 leaves, but usually it is of only 2 leaves or even 1, as in the Cape pond-weed (*A. distachyum* Thunb.) now so much cultivated for its sweet-scented flrs. The one leaf is attached to the axis of the spike by a broad base and looks like a bract. In this sp. the sta. are  $\infty$  and cpls. 3—6, but in most we find A 3+3, G 3. Ovules 2 or  $\infty$  in each, anatropous, erect. Fruit leathery. Embryo straight.

**Aponogetonaceae.** Monocotyledons (Helobiaeae). Only genus *Aponogeton* (q.v.). They are distinguished from Potamogetonaceae by the coloured perianth and straight embryo, from Juncaginaceae by the perianth and the sympodial structure. Benth.-Hooker place them in Naiadaceae with several other orders here treated separately.

**Apostasia** Blume. Orchidaceae (1). 4 sp. E. Ind. to Austr. Flr. almost regular, diandrous; ovary 3-locular.

**Aquifoliaceae** Dicotyledons (Archichl. Sapindales). 5 gen. 180 sp. chiefly Amer. Shrubs and trees with leathery alt. leaves and minute stipules. Infl. cymose. Flr. regular, unisexual, 3—6-merous with no



disc. Usual formula  $K_4, C_4, A_4, \overline{G}(4)$ , 4-locular, with 1 or 2 pendulous anatropous ovules in each. Drupe. Endosperm. *Chief genus.* *Ilex*. [*A.*=*Illicineae* B and H. (coh. *Olacales*); placed in *Frangulinae* by Warming.]

**Aquilegia** (Tourn) Linn Ranunculaceae (2). 50 sp. N. temp. (*A. vulgaris* L., the columbine, in Brit.). The petals are prolonged into long spurs (cf. *Delphinium*), secreting honey that is only accessible to long tongued insects. Sta. often 50 or more, in whorls of 5. Flr. protandrous, fertilised by humble-bees.

**Arabis** Linn. Cruciferae (iv. 15). 100 sp. N. temp., S. Am 5 Brit (rock-cress).

**Araceae** (= *Aroideae* Benth. Hooker) Monocotyledons (Spathiflorae) 105 gen. with abt. 1000 sp. trop. and temp. but chiefly trop (92 %). Many types of vegetative habit occur in the order—herbs, large and small, with aerial stems, tubers or rhizomes, climbing shrubs, climbing epiphytes, marsh plants, one water plant (*Pistia*) &c. In a few *Pothoideae* (the oldest group) the stem is monopodial, but in most *A.* it is sympodial. Each joint of the sympodium begins as a rule with one or more scale leaves before bearing foliage leaves. Accessory (collateral) buds are often found in the leaf axils. Some times, as in *Anthurium*, *Philodendron* &c., the axillary shoot is 'adnate' to the main axis for some distance (cf. *Solanaceae*, *Zostera* &c.). The buds usually appear in the leaf axils, but often get pushed to one side, and sometimes (e.g. *Pothos*) break through the leaf-bases as in *Equisetum*.

The leaves show many types. Pinnately and palmately divided leaves are frequent, but their development is not like that of such leaves in Dicotyledons. Holes are present in the leaves of *Monstera*. See *Nat. Pfl* for details, and genera *Monstera*, *Rhaphidophora*, *Philodendron*, *Heliconia*, *Dracontium*, *Zamioculcas* &c.

The roots are adventitious and mostly formed above ground in the larger forms. Two types of aerial root occur—climbing roots and absorbent roots. The former, like those of ivy, are insensitive to gravity but show great negative heliotropism; they consequently cling closely to the support and force their way into all the crevices of its structure. The latter are insensitive to light, but respond markedly to gravity, they therefore grow down to the soil and enter it, branching out below ground and taking up nourishment.

The larger tropical *A.* show interesting stages in the development of epiphytism (see p. 184). The climbing forms grow to considerable size and form longer and longer aerial roots as they grow upwards. The original roots at the base of the stem thus become of less and less importance and it not uncommonly happens that they die away together with the lower end of the stem, so that the plant thus becomes an epiphyte. Of course, as it still obtains its water &c. from the soil, it is not an epiphyte in the sense that e.g. many

Orchids or Bromeliaceae are such, and it is evident that if this method of becoming epiphytic were the only one found in the order, these plants could with no more justice be classed as true epiphytes than the ivy which may often be seen in the 'bowls' of pollard willows in Europe (see p. 184), and which has got there by climbing up the trunk and dying away below. It is found however that some sp. of *Philodendron*, *Pothos* &c. are able to *commence* life as epiphytes. The fleshy fruit is eaten by birds and the seed dropped on a lofty branch. The seedling forms clasping roots and dangling aerial roots which grow steadily down to the soil, even if it be 100 feet or more away. It is hardly possible to suppose that these true epiphytic sp. have been evolved in any other way than from former climbing sp. The leaves of *Philodendron canniifolium* Schott have swollen petioles full of large intercellular spaces lined with mucilage. When rain falls these become filled with water and act as storage reservoirs. Lastly, some sp. of *Anthurium* &c. are true epiphytes without any connection with the soil (e.g. *A. Hugelii* Schott = *A. Hookeri* Kunth.); they have clasping roots, and also absorbent roots which ramify amongst the humus collected by the plant itself. The aerial roots of some Araceae possess a velamen like that of Orchids. [For further details see p. 184, and Schimper's *Epiph. Veg. Amerikas.*]

The flrs. are without bracts and are usually massed together on a cylindrical spadix enclosed in a large spathe; the spadix usually terminates a joint of the sympodium (the 'continuation' bud is generally in the axil of the leaf next but one before the spathe), so that there is only one formed each year. Flr. ♂ or monœcious (diœcious in *Arisaema*), with or without a perianth. Sta. typically 6 but usually fewer (down to 1), often united into a *synandrium* (e.g. *Colocasia*, *Spathicarpa*); in *Ariopsis* the synandria are again united to one another. Staminodes are often present, and these also may be fused into a *synandrodium* as in *Colocasia*. The gynœceum shows almost every possible variety of structure; it is frequently reduced to 1 cpl. Fruit a berry. The outer integument of the seed is often fleshy. Endosperm or none.

The flrs. are usually protogynous (even when monœcious). In many genera (incl. most in Eur.) the smell is disagreeable and attracts carrion flies as pollen carriers (see *Arum*, *Dracunculus*, *Helicodiceros* &c.).

Many A. contain latex, which is usually poisonous but is dispelled by heat. The rhizomes of many sp. contain much starch and are used as food (*Caladium*, *Colocasia*, *Arum* &c.).

*Classification and chief genera* (after Engler):

The grouping of the A. is very difficult and account has to be taken of histological as well as external characters.

I. *POTHOIDEAE* (land plts.; no latex or raphides; leaves

- 2-ranked or spiral; lateral veins of 2nd and 3rd order netted; flrs. usually ♀): Pothos, Anthurium, Acorus.
- II. *MONSTEROIDEAE* (land plts.; no latex; raphides; lat. veins of 3rd, 4th, and sometimes 2nd orders netted; flr. ♀, usually naked; ovule anatrop. or amphitrop.): Rhaphidophora, Monstera, Spathiphyllum.
- III. *CALLOIDEAE* (land or marsh plts.; latex; flr. usually ♂; ovule anatrop. or orthotrop.; lf. never sagittate, usually net-veined): Symplocarpus, Calla.
- IV. *LASIOIDEAE* (land or marsh plts.; latex; flr. ♂ or ♂ ♀; ovule anatrop.; seed usually exalbum.; lf. sagittate, often much lobed, net-veined): Dracontium, Amorphophallus.
- V. *PHILODENDROIDEAE* (land or marsh plts.; latex; flr. naked, unisex.; ovule anatrop. or orthotrop.; seed usually album.; lf. usually ||-veined): Philodendron, Zantedeschia.
- VI. *COLOCASIOIDEAE* (land or marsh plts.; latex; flr. naked unisex.; sta. in synandria; ovule orthotrop. or anatrop.; seed album. or not; lf. net-veined): Remusatia, Colocasia.
- VII. *AROIDEAE* (land or marsh plts.; latex; flr. unisex., usually naked; sta. free or in synandria; ovule anatrop. or orthotrop.; seed album.; leaves various, net-veined; stems mostly tuberous): Spathicarpa, Arum, Dracunculus, Helicodiceros, Arisaema.
- VIII. *PISTIOIDEAE* (swimming plts.; no latex; flr. unisex., naked; ♂ flrs. in a whorl, ♀ solitary): Pistia (only genus).

Engler gives a genealogical tree of these groups, showing also their relation to Lemnaceae, thus

Monsteroideae

Pothoideae → { Calloideae → Philodendroideae.  
Lasioideae.  
Aroideae → Pistioideae.....LEMNACEAE.

↓  
Colocasioideae.

For further details of this most interesting order, see the account in *Nat. Pfl.* (by Engler), from which much of the above is abridged.

[Placed in Spadiciflorae (Eichl. Warm.), Nudiflorae (B. & H.).]

**Arachis** Linn. Leguminosae (III. 7). 7 sp. Braz. *A. hypogaea* L. is the earth-, ground-, or pea-nut, largely cultivated in warm regions for its seeds, which are edible and which when pressed yield one of the many oils used in place of, or to adulterate, olive oil. The flr. after fertilisation bends downwards (cf. *Linaria*) and the elongation of its stalk forces the young pod under ground, where it ripens.

**Aralia** Tourn. Araliaceae. 30 sp. N. Hemisph. The root of *A. Ginseng* Baill. (*A. quinquefolia* auct.) is the source of the famous Chinese medicine Ginseng. It is much valued in China as a tonic

and stimulant, but is said to be devoid of medicinal value. For *A. papyrifera* Hook. see *Fatsia*.

**Araliaceae.** Dicotyledons (Archichl. Umbelliflorae). 51 gen. 400 sp. mostly trop., the chief centres being the Indo-mal. region and trop. Am. Mostly trees and shrubs; some are almost like palms in habit (p. 165). Many twine, others (e.g. *Hedera*) climb by aid of roots. Leaves usually alt., often large and compound, with small stipules. Flrs. small, in umbels which are frequently massed into large compound infis. Flr. ♂, regular, epigynous, usually 5 (3-∞)-merous. K 5, very small; C 5; A 5;  $\bar{G}$  (5), 5-locular, with 1 anatrop. pendulous ovule in each, the micropyle facing outwards. Styles free or united. Fruit usually a drupe with as many stones as cpls. Embryo small in rich endosperm. *Chief genera:* *Fatsia*, *Hedera*, *Aralia*, *Panax*.

[Placed in Umbelliflorae (Eichl. Warm.), Umbellales (B. and H.)]

**Araucaria** Juss. Coniferae (Arauc. 1 b; see C. for genus characters). 10 sp. S. Am., Austr., divided into 2 sections. To § 1, *Colymbea* (leaves broad, fruiting cpls. not winged), belongs *A. imbricata* Pav. (Chili), the monkey-puzzle of our shrubberies. Its seeds are edible and the wood is useful. *A. Bidwilli* Hook. (Austr.), the Bunya-Bunya pine, also belongs to this section. To § 2, *Eutacta* (needle leaves, scales winged), belong *A. excelsa* R. Br., the Norfolk I. pine, and others.

**Araucariaceae.** An order of Coniferae (q. v.).

**Araujia** Brot. Asclepiadaceae (II. 2). 10 sp. S. Am.

**Arbutus** (Tourn.) Linn. Ericaceae (II. 6). 20 sp. Medit., Orient., N. Am. *A. Unedo* L., the strawberry tree, is abundant at Killarney. The frt. (a dry berry) resembles a strawberry at a distance. It ripens in the second year, so that fr. and frt. occur together on a tree.

**Arceuthobium** Griseb. Lorantheae (2). 9 sp. N. temp. See *Nat. Pfl.* and Johnson in *Ann. of Bot.* II., p. 137.

**Archangelica** Hoffm. Umbelliferae (6). 7 sp. N. temp. The petioles of *A. officinalis* Hoffm. are used in confectionery (angelica).

**Archegoniatae.** A term used to designate that division of the Veg. Kingdom in which the ♀ cell (ovum) is contained in an *archegonium*. i.e. a flask-shaped organ with a neck formed of one layer of cells. It includes the Bryophyta and Pteridophyta.

**Archichlamydeae.** One of the two primary divisions of Dicotyledons (p. 136).

**Archontophoenix** H. Wendl. et Drude. Palmae (IV. 6). 3 sp. E. Austr.

**Arctium** Linn. Compositae (XI). 1 sp., *A. Lappa* L., the burdock, often split into 4 sp., Eur. (incl. Brit.), As. The involucre bracts become hooked and woody after the flrs. wither, and aid in seed distribution. They adhere to the fur or clothes, but are soon torn from their hold and the plant springs back again without parting from them, jerking out the fruits.

- Arctostaphylos** Adans. Ericaceae (11. 6). 18 sp. chiefly N. Am. Two are circumpolar and occur in Brit. (alpine). *A. Uva-ursi* Spreng., the red bearberry, is common in the Highlands, especially on wind-swept ridges and dry places. *A. alpina* Spreng., the black bearberry, is rarer. The former is evergreen, the latter not. On this account and because of its soft berry it is sometimes placed in a separate genus *Arctous* Niedz. The berries form one of the principal foods of grouse &c. The flrs. appear as soon as the snow melts; they resemble those of *Erica* in structure and mechanism.
- Arctotis** Linn. Compositae (x). 58 sp. Afr., Austr.
- Arctous** Niedz. See *Arctostaphylos*.
- Ardisia** Sw. Myrsinaceae (11). 200 sp. Some show 'vivipary' like *Rhizophora* (*g. v.*).
- Arduina** Mill. = *Carissa* Linn.
- Areca** Linn. Palmae (1v. 6). About 15 sp. Malacca to New Guinea. *A. Catechu* L. is largely cultivated in trop. As. for its seeds (Areca or Betel nuts). The infl. is below the oldest living leaves, monœcious, with the ♀ flrs. at the bases of the twigs, the ♂ above. The seed is about as big as a damson; it is cut into slices and rolled up in a leaf of Betel pepper (*Piper Bette*) with a little lime. When chewed, it turns the saliva bright red; it acts as a stimulus upon the digestive organs, and is supposed by the natives (who use it habitually) to be a preventive of dysentery. For *A. olceracea* Jacq. see *Oreodoxa*.
- Arenaria** Linn. (incl. *Alsine* Scop., *Cherleria* Hall., *Honckenya* Ehrh., *Moehringia* L.). About 150 sp. cosmop. 8 in Brit. (sandworts), of which the most noteworthy is *A. (Honck.) peploides* L. the sea-purslane, common on sandy coasts. It has long creeping stems below the sand, bearing scale leaves; the green leaves are fleshy with water storage tissue (p. 187). *A. Cherleria* Hook. (*C. sedoides* L.), the cyphel, is a tufted alpine plant (p. 190) common in the Highlands.
- Arenga** Labill. Palmae (1v. 6). About 8 sp. E. Ind. Like *Caryota*, but the spadix unisexual. Sta. ∞, cpls. 3. *A. saccharifera* Labill., the Gomuti palm, is largely cultivated as a source of palm sugar (jaggery), obtained by evaporation of the sap that flows from wounds made in the young infl. The tree only flowers once. A variety of sago is obtained by washing and granulating the pith.
- Arethusa** Gronov. Orchidaceae (4). 2 sp. Japan and N. Am.
- Aretia** Hall. Merged in *Androsace* L. (12 sp. Eur., Siber.).
- Argania** Roem. et Schult. Sapotaceae (1). 1 sp. *A. Sideroxylon* R. & S., in Morocco. The fruit is eaten by cattle; the pressed seeds yield Argan oil, used instead of olive oil.
- Argemone** Tourn. Papaveraceae (11). 6 sp. trop. Am.
- Argyrela** Lour. Convolvulaceae (1. 4). 25 sp. trop. As., Afr.
- Argyrolobium** Eckl. et Zeyh. Leguminosae (111. 3). 40 sp. Afr., Medit., Ind. Mostly xerophytes.

**Ariopsis** J. Grah. Araceae (vi). 1 sp. E. Ind., *A. peltata* J. G., a small tuberous herb with hood-like spathes whose openings face downwards so that the flrs. are protected from rain &c. The few ♀ flrs. are at the base of the spadix, the ♂ above. This part is full of round holes leading into pear-shaped cavities surrounded each by a synandrium of 6-8 sta. The synandria are fused to each other so that the surface of the spadix is continuous from the opening of one flr. to that of the next.

**Arisaema** Mart. Araceae (vii). 50 sp. As., Abyss., N. Am. Like *Arum*, but dioecious. It is said to be fertilised by snails (cf. *Alocasia*).

**Arisarum** (Tourn.) Targ. Araceae (vii). 3 sp. Medit.

**Aristea** Soland. Iridaceae (ii). 14 sp. S. Afr., Madag.

**Aristida** Linn. Gramineae (viii). 100 sp. temp. and sub-trop.

**Aristolochia** Tourn. Aristolochiaceae. 180 sp. trop. and temp. They are herbs with rhizomes, or twining lianes. Of the latter *A. Gigas* Lindl., the pelican flower, is often grown in hot-houses for the sake of its enormous flrs. Many trop. sp. have a small leaf surrounding the stem at the base of each ordinary leaf, and looking like a stipule. This is really the first leaf of the axillary shoot, which grows very rapidly at first. In other cases this leaf remains small and its shoot does not develop, so that it looks like an interpetiolar stipule. In most sp. several buds are formed in each leaf axil; the flrs. usually come from the upper ones.

*A. Clematitis* L. (birthwort) occurs as an escape in Brit. The perianth is tubular, hooded at top, and enlarged below round the gynostemium; this has 6 sessile extrorse anthers below and as many stigmatic lobes above (these are really not the true stigmas, but the connectives of the anthers, which have assumed stigmatic functions). The young flr. stands erect and the perianth-tube contains numerous hairs, which are jointed at the base in such a way that they can easily be bent downwards but not upwards. There is no honey. Small flies enter the flr. at this stage and find the stigmas ripe, so that if they bear pollen from other flrs. fertilisation takes place. They are unable to escape until in the course of a day or two the pollen is shed, and then the hairs wither, the flr. at the same time bending downwards (cf. *Arum*). In *A. Siphon* L'Hérit. (Dutchman's pipe) the perianth is bent like a siphon and has a polished interior surface. The mechanism of all *A.* wants further investigation. It seems probable that there is a large amount of self-fertilisation.

**Aristolochiaceae**. Dicotyledons (Archichl. Aristolochiales). 5 gen. with 200 sp., trop. and warm temp., except Austr. Herbs or shrubs, in the latter case usually twining lianes. Leaves alt., stalked, often cordate, usually simple, exstipulate. Flr. ♂, epigynous, regular or zygomorphic. P. usually (3), petaloid. Sta. 6—36, free, or united with the style into a gynostemium (cf. *Asclepiads*, *Orchids* &c.).

Ovary 4—6-loc.; ovules  $\infty$  in each loc., anatropous, horizontal or pendulous. Capsule. Embryo small in rich endosperm. The A. are difficult to place in the natural system. They have been put near Dioscoreaceae, though they are not monocotyledonous. Benth.-Hooker place them in Multiovulatae Terrestres, Eichler (Warming) in Hystero-phyta. *Chief genera*: *Asarum*, *Aristolochia*.

**Aristolochiales.** The 8th cohort of Dicot. Archichl. (see p. 136).

**Aristotelia** L'Hérit. Elaeocarpaceae. 10 sp. S. temp.

**Armeria** Linn. Plumbaginaceae. 50 sp. N. temp. and andine. *A. vulgaris* Willd., the thrift or sea pink, is common on the coast of Brit. and in high mountain regions of Scotland (see p. 189). The primary root is perennial; each year's shoot dies down all but a short piece, on which the following year's shoot arises as an axillary branch. The infl. is a capitulum of cincinni, surrounded by a whorl of bracts, the outer ones forming a sheath round the top of the peduncle. After fertilisation the calyx becomes a membranous funnel-like organ aiding seed-distribution by wind.

**Arnebia** Forsk. Boraginaceae (IV. 4). 12 sp. Medit., Himal. Some have black spots on the corolla, which fade out as it grows older (see order, and cf. *Diervilla*, *Fumaria* &c.).

**Arnica** Rupp. Compositae (VIII). 18 sp. N. temp. and arctic.

**Arnoseric** Gaertn. Compositae (XIII). 1 sp., *A. pusilla* Gaertn., in Eur. (incl. Brit.). The bases of the involucre bracts enclose the ripe fruits (cf. *Rhagadiolus*).

**Aroideae** (Benth.-Hook.) = Araceae.

**Arrhenatherum** Beauv. Gramineae (IX). 3 sp. Eur., Medit. *A. avenaceum* Beauv., the false oat-grass or French rye-grass, in Brit.

**Artabotrys** R. Br. Anonaceae (6). 23 sp. Old World trop. They are cultivated for their sweetly scented flrs. and edible fruit. They usually climb by aid of recurved hooks, which are modified inflorescence-axes.

**Artanthe** Miq. = Piper Linn. (usually same spec. names; *A. elongata* Miq. = *P. angustifolium*).

**Artemisia** Linn. Compositae (VII). 200 sp. N. Hemisph., very common on the arid soil of the western U.S., the Steppes &c. 4 in Brit. (wormwood). Flr.-heads small, inconspicuous, and wind fertilised (cf. *Poterium*, *Rheum* and *Rumex*, *Plantago*, *Thalictrum*, &c.). In *A. vulgaris* L. the marginal florets are ♀, the rest ♂. The head is pendulous; the anther-tube projects beyond the corolla, so, that the dry powdery pollen is exposed to the wind. On the tips of the anthers are long bristles which together form a temporary pollen-holder. Afterwards the style emerges and the large hairy stigmas spread out. The flr. affords a very interesting case of reacquisition of a character not found in most higher flowering plants.

**Arthraxon** Beauv. Gramineae (II). 9 sp. trop. Old World.

**Arthropodium** R. Br. Liliaceae (III). 8 sp. Austr., N.Z., New Caled.

**Arthrotaxis** Endl. = *Athrotaxis* D. Don.

**Artocarpus** Forst. 'Moraceae (II). 40 sp. Ceylon to China and Malay Arch. Many sp. show good bud-protection (p. 168) by the stipules. *A. laciniata* Hort. has large drip-tips (p. 154 and art. *Ficus*). Flrs. monoecious, the ♂ in pseudo-catkins, the ♀ in pseudo-heads. A multiple fruit is formed, the achenes being surrounded by the fleshy perianth and the common receptacle also becoming fleshy. The fruit contains much starch &c. and is a valuable food-stuff. Several sp. are cultivated all over the Trop., e.g. *A. incisa* L. (Bread-fruit tree) and *A. integrifolia* L. (Jack tree). The flesh has the texture of bread and is roasted before being eaten. The best cultivated forms (cf. pear, banana &c.) produce no seeds.

**Arum** (Tourn.) Linn. Araceae (VII). 15 sp. Eur., Medit. *A. maculatum* L. (cuckoo-pint, wake-robin, or lords and ladies) in Brit. It is a perennial, tuberous plant with monoecious flrs.; ♀ flrs. at base of spadix (each of 1 cpl., naked) and ♂ above (each of 2—4 sta.), and above these again rudimentary ♂ flrs. represented by hairs which project outwards and close the mouth of the spathe. The foetid smell attracts small flies, which enter the spathe, find the stigmas ripe, and are kept prisoners till the pollen is shed; then the hairs wither and escape is possible (cf. *Aristolochia*). Fruit a berry. The starch of the tubers was formerly used as food under the name Portland arrow-root, but it is very difficult to get rid of the poisonous juices accompanying it. Other species are similarly used in Eur.

**Arundinaria** Michx. Gramineae (XIII). 25 sp. As., Am. Like *Bambusa*.

**Arundo** Tourn. Gramineae (XI). 3 sp. trop. and temp. For *A. Phragmites* L. (Brit.) see *P. communis*. The stems of *A. Donax* L. are used for sticks, fishing-rods &c.

**Asarum** (Tourn.) Linn. Aristolochiaceae. 13 sp. N. temp. *A. europaeum* L., the asarabacca, is wild in Brit., but only as an escape from cultivation, it having been formerly medicinal. There is a rhizome below ground and creeping shoots above; the latter are sympodial, each annual joint bearing several scale leaves below, then two green leaves and a terminal flr. Flr. regular; P (3), sometimes with 3 small teeth between the segments (perhaps remnants of a former inner whorl); A 12; G (6). The dark-brown, resinously scented flr. is visited by flies, and is very protogynous; when the stigmas are ripe the sta. are all bent away, but later on they move up to the centre and dehisce extrorsely. The perianth lobes are bent in at first towards the centre of the flr. and form a sort of prison of it, but afterwards gradually straighten themselves. Müller regards the flr. as representing a stage in the development of the *Aristolochia* prison.

**Asclepiadaceae.** Dicotyledons (Sympet. Contortae). 218 genera with over 1300 sp. They are mostly confined to the Tropics (esp. Afr.),



but there are a few in temp. regions. In vegetative habit they resemble Apocynaceae; some are perennial herbs, but the most are climbing shrubs or lianes, with simple, entire, opposite, exstipulate leaves. Latex is present. A large number, especially of the S. Afr. sp., are xerophytic; some, *e.g.* *Periploca*, with much reduced leaves, others, *e.g.* *Hoya*, and still more, *Stapelia*, with fleshy stems. Epiphytes also occur, of which the most interesting is *Dischidia*.

The infl. usually includes many flrs. and may be cymose or racemose (raceme or umbel). In the former case it is a dichasium, but as in Caryophyllaceae the one branch tends to outgrow the other, and a monochasial (cincinnus) arrangement may arise in the later branchings. When the infl. is axillary, there is usually only one at each node; in the axil of the other leaf there is a vegetative shoot, or nothing. In some of the genera (see *Asclepias*) the infl. is extra-axillary. The flr. is ♂, regular, 5-merous, usually small. K 5, quincuncial, the odd sepal posterior; C (5) usually rotate or campanulate, with convolute or valvate aestivation. The essential organs (5 sta., 2 cpls.) form a complex structure. The sta. and style are usually united to form a *gynostegium*. The cpls. are free below as in Apocynaceae, but united at the tip with a common style; the ovary is superior. The head of the style is large and variously shaped, and the stigmatic surface is usually upon the edge or under side of it. To its margin are united the anthers of the 5 epipetalous sta.; the filaments of these are short or non-existent. The pollen in the lower group of A. (see below) is united merely in tetrads, in the higher group, comprising the bulk of the order, into pollinia, as in Orchidaceae. Usually each anther contains two. In this group also there are curtain-like projections at the sides of the anthers, leaving a narrow slit between each pair of anthers.

The pollen is removed from the anthers by a curious mechanism—the *translator*, to borrow the new word introduced by Schumann. This differs in the two suborders and so also does the fertilisation method. The translator always stands between two anthers and serves to carry away half the pollen from each of them. In the *Periplocoideae* it is a spoon- or funnel-like body with a sticky disc at the narrow end. Into it is shed the pollen from the two half anthers next to it, and as the sticky disc projects outwards in the male stage of the flower an insect will be likely to get it attached to its head, and carry it about like the pollinia of an orchid. In visiting a second flower the pollen may be placed on the stigmatic surface. In the *Cynanchoidae*, on the other hand, there are pollinia, and the translator has a different structure. It forms an inverted  $\Lambda$ -shaped organ, the foot of the Y being formed by the adhesive body (or *corpusculum* as it is sometimes called); from this diverge the threads (*retinacula*) which are attached to the pollinia, one in each anther. An insect in obtaining honey catches its leg in the slit between the anthers, and in

drawing it up removes the pair of pollinia. The threads as they dry contract on the inner side till the pollinia meet, thus closely clasping the insect's leg. In drawing the leg through a similar slit in another flr. the pollinia catch on the stigmatic under-surface of the stylar head. (Cf. Apocynum, which shows an approach to this mechanism.)

The backs of the anthers bear as a rule curious appendages (*cuculli*) forming a *corona*. In some cases the corona springs from the corolla. It may consist simply of small teeth, or be more complex in structure, as in *Asclepias* and *Ceropegia*. It often takes up the functions of secreting and storing the honey.

The ovary is bilocular, superior, with  $\infty$  anatropous ovules, pendulous from the ventral placentae. The fruit consists of a pair of follicles; the seeds are usually crowned by a tuft of hairs for wind-carriage. Endosperm slight, cartilaginous.

*Classification and chief genera* (after K. Schumann):

- I. *PERIPLOCOIDEAE* (pollen in tetrads; translator spoon-like).
  1. *Periploceae*: *Streptocaulon*, *Periploca*.
- II. *CYNANCHOIDAE* (pollinia; corpusculum &c.).
  2. *Asclepiadeae* (pollinia pendulous on threads): *Asclepias*, *Cynanchum*.
  3. *Secamoneae* (pollinia erect or horizontal, 4 in each anther): *Secamone* (only genus).
  4. *Tylophoreae* (do. but 2 in each, erect): *Ceropegia*, *Stapelia*, *Stephanotis*, *Hoya*.
  5. *Goniolobeae* (do. but 2 in each, horiz.): *Gonolobus*.

The order is closely related to Apocynaceae, the only absolute character of distinction being the presence of translators in *Ascl.*; otherwise the two sub-orders of each form a corresponding series, and the lower one in each is almost as nearly related to the corresponding one in the other order as to the higher group in its own order. A. are placed in Contortae by Eichler (Warming), and in Gentianales by Benth.-Hooker.

**Asclepias** Linn. Asclepiadaceae (II. 2). 80 sp. Am., Afr., chiefly in the U.S. (silk-weeds). Erect herbs with umbellate infls. which spring from the stem between the petioles of the opposite leaves (cf. *Cuphea*), or above or below this point. Two explanations are forthcoming, but which is right the evidence at present available does not show. Either the infl. is really axillary to the leaf below it and is 'adnate' to the stem (as in *Cuphea*), or it is the termination of a shoot, and the stem is really a sympodium.

The cuculli of the anthers form little pockets, into which honey is poured by the horn-like nectaries that project from them. Insects walking over the flowers and sipping honey frequently slip their legs down the sides of the gynostegium, and in drawing them up catch in the slit between two anthers and remove the pollinia (see order for

details). The process may be watched on *A. Cornuti* Dcne. in gardens.

**Asimina** Adans. Anonaceae (2). 6 sp. East. U.S.

**Aspalathus** Linn. Leguminosae (III. 3). 150 sp. S. Afr. Many are xerophytes with a heath-like habit.

**Asparagus** Tourn. (incl. *Myrsiphyllum* Willd.). Liliaceae (VII). 100 sp. Old World, mostly in dry places. Rhizome with aerial shoots; leaves reduced to scales with linear green shoots in their axils, usually in tufts. These are small condensed cymes, of the type stem shown in the diagram (figs. represent the branches of successive orders). The number of shoots that develop varies. In the infl. the same construction holds, the shoots bearing the fls. In the sub-genus *M.* there are flat phyllodes (cf. *Ruscus*). Fruit a berry. *A. officinalis* L. is largely cultivated as a vegetable; the young shoots are eaten.

**Aspasia** Lindl. Orchidaceae (28). 8 sp. trop. Am.

**Asperifoliae** = Boraginaceae.

**Asperugo** (Tourn.) Linn. Boraginaceae (IV. 2). 1 sp. Eur., As.

**Asperula** Linn. Rubiaceae (II. 21). 80 sp. Eur., As., Austr. &c., chiefly Medit. *A. odorata* L. (woodruff) and *A. cynanchica* L. (squincancy-wort), in Brit. Flrs. homogamous. Those of the latter sp. show two forms, one with smooth white obtuse petals, one with rough reddish acute petals. The fruit of woodruff is hooked.

**Asphodeline** Rchb. Liliaceae (III). 14 sp. Medit.

**Asphodelus** (Tourn.) Linn. Liliaceae (III). 7 sp. Medit. (the Asphodel). Its leaves are isobilateral and flrs. protogynous.

**Aspicarpa** Rich. Malpighiaceae. 5 sp. Texas to Argentina.

**Aspidistra** Ker-Gawl. Liliaceae (VII). 3 sp. E. As. *A. elatior* Blume is often cultivated. The large flat style forms a lid to the cavity of the flr. made by the 8 perianth-leaves. Into this the pollen is shed, and it is supposed that the mechanism is like that of *Arum*. Others suggest that it is snail-fertilised.

**Aspidium** Sw. *Synonymy*: *A. aciculatum* Sw., *cristatum* Sw., *dilatatum* Willd., *Filix-mas* Sw., *Oreopteris* Sw., *rigidum* Sw., *spinulosum* Sw., *Thelypteris* Sw. = *Nephrodium* (same spec. names); *A. Filix-foemina* Sw. = *Asplenium* F.-f.

Polypodiaceae 60 sp. cosmop. *A. aculeatum* Sw. (prickly shield-fern) and *A. Lonchitis* Sw. (holly-fern) in Brit.

**Asplenium** Linn. Polypodiaceae. About 300 sp. cosmop. 11 sp. in Brit., including *A. Filix-foemina* Bernh. (lady-fern), *A. Ruta-muraria* L. (wall-spleenwort), *A. Trichomanes* L. (spleenwort) and *A. Adiantum-nigrum* (black spleenwort). The var. *clarissima* of the lady-fern shows apogamy (see Filicineae, Lepto.). *A. bulbiferum* Forst. and other sp. are 'viviparous,' producing young plants on their leaves by vegetative budding (not to be confounded with apospory). *A. Nidus*

L. (the bird's-nest fern) is an interesting epiphyte of the Old World tropics. It bears a rosette of leaves forming a nest in which humus collects; the roots ramify in this and obtain food and water. *A. rhizophyllum* Kunze is the walking fern, so-called because the leaf-tips when they touch the soil bud into new individuals, and thus the plant spreads to some distance.

**Astelia** Banks et Soland. Liliaceae (vi). 9 sp. Polynes. Dioecious.

**Aster** Tourn. Compositae (iii). 200 sp. Am., As., Afr., Eur. 2 sp. on the coast of Brit. (Michaelmas daisy), both, like so many shore plants (p. 187), somewhat fleshy. The China-aster of gardens (*A. chinensis* L.) is a sp. of *Callistephus*.

**Asterales**. The 2nd cohort of Dicotyledons (Gamopet.) in the classification of Bentham and Hooker. See p. 143.

**Astilbe** Buch.-Ham. Saxifragaceae (i). 6 sp. As., N. Am.

**Astragalus** Tourn. Leguminosae (iii. 6). Abt. 1200 sp. cosmop., except Austr. 3 in Brit. (milk-vetch). The bulk are N. temp. plants living on steppes, prairies &c. and are more or less xerophytic. A great number are thorny; the thorns commonly form by the stiffening of the petiole or midrib of the leaf when the blade falls off. *A. gum-mifer* Labill. and others yield gum-tragacanth, obtained by wounding the stem and allowing the resin to exude and harden.

**Astrantia** (Tourn.) Linn. Umbelliferae (3). 5 sp. Eur., As.

**Astrocarpus** Neck. Resedaceae. 1 variable sp. S. W. Eur.

**Astrocaryum** G. F. W. Mey. Palmae (iv. 7). 29 sp. trop. Am.

**Asystasia** Blume. Acanthaceae (iv. 8). 20 sp. Old World trop.

**Atalantia** Corréa. Rutaceae (x). 12 sp. trop. As., China, Austr.

**Athamanta** Linn. Umbelliferae (6). 3 sp. Eur., W. As.

**Athanasia** Linn. Compositae (vii). 40 sp. S. Afr.

**Athrotaxis** D. Don. Coniferae (Arauc. 1c; see C. for genus characters). 4 sp. Tasm.

**Athyrium** Roth. = *Asplenium* Linn.

**Attractylis** Linn. Compositae (xi). 15 sp. Medit. to Japan.

**Atragene** Linn. = *Clematis* Linn.

**Atriplex** (Tourn.) Linn. Chenopodiaceae (4). 120 sp. temp. and sub-trop. 6 in Brit. (orache). Flrs. unisexual, naked or with perianth.

**Atropa** Linn. Solanaceae (ii). 2 sp. Eur., Medit., As. *A. Belladonna* L. is the deadly nightshade. It contains the alkaloid atropin, the basis of the drug belladonna used in medicine.

**Attalea** H. B. et K. Palmae (iv. 7). 23 sp. S. Am. *A. funifera* Mart. yields some of the Piassaba fibre of commerce.

**Aubrietia** Adans. Cruciferae (iv. 14). 12 sp. Medit.

**Aucuba** Thunb. Cornaceae. 3 sp. Himal. to Japan. *A. japonica* Thunb. is the Japan laurel of our shrubberies. It is dioecious.

**Augusta** Leandr. = *Stiffia* Mikan.

**Avellinia** Parl. Gramineae (xi). 1 sp. Medit.

**Avena** Linn. Gramineae (ix). 50 sp. temp. 2 in Brit. (oat-grass). *A.*

*sativa* L., the cultivated oat, is perhaps derived from *A. fatua* L. It is cultivated in Eur. to  $69\frac{1}{2}^{\circ}$  N. and forms the staple of the food of a large population. [See De Candolle's *Orig. of Cult. Plts.* p. 373.] The 2—6-flowered spikelets form a loose panicle. The paleae are awned, the awn of the inf. palea being usually twisted and hygroscopic. In *A. sterilis* L. the awns cross, and when wetted try to uncurl and thus press on one another till a sort of explosion occurs jerking away the fruits.

**Averrhoa** Linn. Oxalidaceae. 3 or 4 sp. trop. As. (?). *A. Bilimbi* L., the Blimbing, is cultivated for its fruit, which is borne on the older stems (p. 167).

**Avicennia** Linn. Verbenaceae (VII). 3 sp. trop., forming one of the constituents of the mangrove-vegetation (p. 188). They have the same vivipary, habit &c., and show aerial roots projecting upwards out of the mud like those of *Sonneratia*.

**Azalea** Linn. Now united to *Rhododendron* Linn., from the type form of which it is chiefly distinguished by its 5 sta. and annual leaves. For *A. procumbens* L. (Brit.) see *Loiseleuria*.

**Azara** Ruiz et Pav. Flacourtiaceae. 22 sp. Mex. and S. Am., chiefly Chili. Shrubs with alt. leaves; one stipule is frequently almost as large as the leaf to which it belongs, giving the appearance of a pair of leaves not opposite to one another. The flr. is apetalous and the outer sta. often without anthers.

**Azima** Lam. Salvadoraceae. 2 sp. trop., Afr., As., Polyn. In the leaf axils are thorns (the leaves of an undeveloped shoot, cf. *Cactaceae*). Flr. polypetalous.

**Azolla** Lam. Salviniaceae. 4 sp. trop. and sub-trop. The general structure is like that of *Salvinia*. Two leaves are formed at each node, from the dorsal half of a segment of the apical cell; from the ventral half are formed roots and branches, but not at every node. The leaves are all alike; each is bilobed and has a small cavity near the base, opening to the outside by a small pore, and inhabited by the Alga *Anabaena*. The roots hang freely down in the water; usually the root cap is thrown off after a short time and the root comes almost exactly to resemble the submerged leaf of *Salvinia*. The sporocarps are formed in pairs (4 in *A. nilotica*) on the ventral lobes of the first leaves of the branches. Each contains one sorus. The microspores are joined together into several masses in each sporangium by the hardened frothy mucilage (epispore, cf. *Salvinia*). Each of these *massulae* has its outer surface provided with curious barbed hairs (*glechidia*), and escapes from the sporangium on its own account. The megasporangium contains one spore. It sinks to the bottom and at length decay of the indusium frees the spore and it germinates, giving rise to a female prothallus which floats about on the water and may be anchored to a floating massula by the barbs.

**Azorella** Lam. Umbelliferae (I). 35 sp. S. temp. Densely tufted

- xerophytes. *A. caespitosa* Vahl. is the Balsam-bog of the Falkland Is., forming tufts like those of *Raoulia*.
- Babiana** Ker-Gawl. Iridaceae (III). 30 sp. S. Afr., Socotra.
- Baccaurea** Lour. Euphorbiaceae (A, I. 1). 50 sp. W. Afr., E. Ind., Polynes.
- Baccharis** Linn. Compositae (III). 300 sp. Am. Some are leafless xerophytes with winged or cylindrical green stems.
- Backhousia** Hook. et Harv. Myrtaceae (2). 5 sp. Austr.
- Bactris** Jacq. Palmae (IV. 7). 90 sp. S. and Centr. Am. Flrs. in groups of 3, one ♀ between two ♂. *B. minor* Jacq. is the Pupunha or peach-palm, cultivated in Brazil for its edible fruit.
- Baeckia** Linn. Myrtaceae (2). 60 sp. Austr. to China.
- Baeria** Fisch. et Mey. Compositae (VI). 20 sp. Calif.
- Bahia** Lag. Compositae (VI). 12 sp. W. Am.
- Balanophora** Forst. Balanophoraceae. 11 sp. Indo-mal.
- Balanophoraceae**. Dicotyledons (Archichl. Santalales). 15 gen. with 40 sp., all but one trop. Parasites on tree roots, to which the tuberous rhizome is attached by suckers (p. 194). From it springs the infl. (sometimes developed within the rhizome and breaking through it), which comes above ground as a spike or head with scaly leaves and small unisexual flrs. For details and figures see *Nat. Pfl.*, or Kerner's *Nat. Hist. of Pl.* Chief genera: *Cynomorium*, *Scybalium*, *Balanophora*, *Langsdorffia*. [Placed in *Achlamydsoporeae* by Benth.-Hook., in *Hysterophyta* by Eichler (Warming).]
- Balbisia** Cav. Geraniaceae. 3 sp. Chili, Peru.
- Baldwinia** Nutt. (*Balduina*). Compositae (V). 4 sp. N. Am.
- Ballota** Linn. Labiatae (v. 2). 25 sp. Eur., Medit. *B. nigra* L., the foetid horehound, is a common weed in Brit.
- Baloghia** Endl. Euphorbiaceae (A, II. 5). 14 sp. E. Ind. to New Caled.
- Balsaminaceae**. Dicotyledons (Archichl. Sapindales). 2 gen. with 230 sp., As., Afr., Eur., N. Am. Herbs with watery translucent stems and alt. leaves, usually exstip. Flr. ♂, zygomorphic. K 5 (the 2 anterior small or aborted, the posterior one spurred), petaloid; C 5 (the lateral petals united in pairs); A 5, the anthers adhering to one another and forming a cap over the ovary, whose growth ultimately breaks the sta. at their bases; G (5), 5-loc., with ∞ ovules, anatropous, pendulous with dorsal raphe. Fruit an explosive capsule. Seed exalb. Chief genus: *Impatiens*. Benth. Hooker unite B. with Geraniaceae (q. v.), but the arrangement of the ovule does not agree with that of G., being that of coh. Sapindales. Eichler and Warming place B. as an independent order in *Gruinales*.
- Balsamodendron** Kunth. = *Commiphora* Jacq.
- Bambusa** Schreb. Gramineae (XIII). 50 sp. As., Afr., Am., trop. and sub-trop. The bamboos are giant grasses, with much-branched

rhizomes below ground and erect perennial woody stems above, which in some sp. reach a height of 120 ft. and a thickness of 12 inches. During the rainy season the rhizome gives off several of these shoots, which rapidly grow (sometimes 3 ft. in a day) to their full size. Spikelets 2- to many-flowered, in racemes or panicles. Some sp. flower annually, others at longer intervals, e.g. *B. arundinacea* Retz. every 32 years in Further India (the last time was in 1868). This phenomenon may be compared with that seen in *Fagus*, but seems to be largely bound up with the age of the plants, for cuttings flower simultaneously with the parent stock. The production of so many seeds at once has twice caused a plague of rats and mice in Brazil. The seedling plants grow for several years without forming tall shoots, expending their energies upon the production of the rhizomes.

The economic uses of bamboos are very numerous, especially in Asia. The stems are hollow, with cross partitions at the nodes, and the wood is elastic and very hard owing to the deposition of silica in the cell walls. The stems are used in building, entire as posts, and split as roofing tiles. They also furnish waterpipes and vessels, gutters, floats, beehives, walking sticks, pipes, flutes, &c. Split bamboo is woven into mats, &c., and used also in making umbrellas, hats, and many other articles. Paper is made from the leaf sheaths. The young shoots are eaten like asparagus, and the seeds are also used as food by the poorer natives. In the stems of *B. arundinacea* and others, curious concretions of silica are formed, known as Tabaschir and used in the East as a medicine in many diseases. For further details see the account in *Nat. Pfl.* by Sir D. Brandis, from which the above is abridged.

**Banisteria** Linn. Malpighiaceae. 70 sp. trop. S. Am. The fruit is remarkably like that of *Acer*.

**Banksia** Linn. Proteaceae (II). 46 sp. Austr. Shrubs and trees with the usual xerophytic habit of the order. Flrs. in dense spikes. Frt. a hard woody follicle enclosed in a number of woody twigs derived from the bract and bracteoles. Seeds winged.

**Baptisia** Vent. Leguminosae (III. 2). 14 sp. N. Am. In *B. perfoliata* R. Br. there are perfoliate leaves which are really in two vertical ranks, but become one-ranked by twisting of the internodes alternately right and left.

**Barbarea** R. Br. Cruciferae (II. 11). 14 sp. Eur., Medit., As., N. Am. 2 in Brit. (yellow rocket or winter-cress).

**Barclaya** Wall. Nymphaeaceae (III). 3 sp. Indo-mal. K 5 hypogynous; C up to (21), epigynous, tubular; A  $\infty$ ; G (10—12) with projections forming a tube above the stigmatic disc.

**Barkhausia** Moench. = *Crepis* Linn.

**Barleria** Linn. Acanthaceae (IV. A). 100 sp. trop., mostly on steppes. The bracteoles are frequently represented by thorns. The seeds have

surface hairs which swell when wetted and help to anchor them to suitable places for germination (p. 105).

**Barnadesia** Mutis. Compositae (XII). 12 sp. S. Am. Shrubs

**Barosma** Willd. Rutaceae (IV). 15 sp. S. Afr.

**Barringtonia** Forst. Lecythidaceae. 30 sp. E. Afr to Samoa. The wood of some sp. is useful and the seeds yield oil, used for lamps

**Bartonia** Muhl. Gentianaceae (I. 2). 3 sp. N. Am. Saprophyte, with a little chlorophyll and leaves reduced to scales.

*do.* Sims. (in Loasaceae) = *Mentzelia* Linn.

**Bartramia** Linn = *Triumfetta* Linn.

**Bartsia** Linn. (incl. *Odontites* Hall.). Scrophulariaceae (III. 12). 60 sp. N. temp., trop. Mts., and S. Am. *B. Odontites* Huds. and 2 others, in Brit. Mostly herbs, semi-parasitic (on grass-roots, see order). Flr with loose pollen mechanism (see order).

**Basella** (Rheede) Linn. Basellaceae 1 sp. trop. As. A climbing herb whose flrs. remain closed; their mechanism requires investigation The fruit is enclosed in the perianth

**Basellaceae**. Dicotyledons (Archichl. Centrospermae) A small family united with Chenopodiaceae by Benth.-Hooker and Warming, but differing in their internal anatomy as well as in morphology They possess an underground rhizome or tuber, giving off annually a climbing shoot, often with fleshy leaves, and racemes or panicles of flrs. These are stalked and often conspicuously coloured Each has 2 bracteoles, 2 sepals, and 5 petals. Opposite these are 5 stam. Ovary superior, of 3 cpls., with terminal style and 3 stigmas, unilocular. Ovule 1, basal, campylotropous Fruit usually a berry  
*Chief genera* Basella, Ullucus, Boussingaultia.

**Bassia** Koenig (*Illipe* F. Muell.). Sapotaceae (I) 30 sp. Indo-mal. &c *B. pallida* Burck yields a gutta-percha. The seeds of *B. butyracca* Roxb yield a butter like substance, used for soap-making &c. The flrs. of *B. latifolia* Roxb., the Moa or Mahwah, are edible, and the wood valuable

**Batatas** Choisy = *Ipomaea* Linn (*B. edulis* Ch. = *I. Batatas* Poir.).

**Batidaceae**. Dicotyledons (Archichl. Centrospermae). Only genus *Batis* (q 2.). See *Nat Pf.* Placed in *Curvembryae* by Benth.-Hooker and Warming.

**Batis** Linn Batidaceae. 1 (or more ?) sp., coasts N. Am

**Batrachium** S. F. Gray = *Ranunculus* Tourn. (the aquatic sp.).

**Batschia** Vahl. = *Humboldtia* Vahl. (Leguminosae).

**Bauera** Banks. Saxifragaceae (VII). 3 sp. temp E. Austr. Shrubs. Flrs. solitary, axillary, 4—10-merous. Sta. = pet. or ∞.

**Bauhinia** Linn. Leguminosae (II. 4). 150 sp. trop. Many are lianes (p. 178). Their stems are curiously shaped, flattened or corrugated and twisted in various ways (figs in Kerner's *Nat. Hist. of Pl.*) "One is the most extraordinary among the climbers of the forest, its broad flattened woody stems being twisted in and out in a most



singular manner, mounting to the summits of the very loftiest forest trees and hanging from their branches in gigantic festoons many hundred feet in length" (Wallace, *Amaz.*). Some sp. have tendrils (branches). The stem of the climbing sp. has a peculiar mode of growth in thickness (cf. other lianes and see De Bary's *Anat.* or *Nat. Pfl.*). In some the young leaves droop like those of other trop. plants (p. 168). In the axils of the stipules are usually found small linear trichome structures; in some sp. they form stout interstipular thorns. Great variety occurs in the floral structure (see *Nat. Pfl.*).

**Beaucarnea** Lem. = *Nolina* Michx.

**Beaufortia** R. Br. Myrtaceae (2). 13 sp. W. Austr. Some sp. are cultivated in greenhouses for their showy flrs.

**Beaumontia** Wall. Apocynaceae (II. 4). 4 sp. E. Ind.

**Beckmannia** Host. Gramineae (X). 1 sp. N. temp.

**Begonia** (Tourn.) Linn. Begoniaceae. Over 400 sp. trop., especially in Am. Many are cultivated in our greenhouses for their handsome flrs. and foliage. Most are perennial herbs with thick rhizomes or tubers. Several climb by aid of roots like ivy. Leaves radical or alt., in two ranks, with large stipules. One side of the leaf is larger than the other, whence the name 'elephant's ear,' by which they are sometimes known. The surface of the leaf is easily wetted, and drip-tips are frequent (p. 154 and art. *Ficus*). In the leaf axils groups of little tubers are frequently found; these are not axillary branches, but are borne upon the true axillary branch, which does not lengthen. Begonias also reproduce very easily by means of adventitious buds (p. 115). These readily form on pieces of leaves cut off and placed on the soil under suitable conditions of moisture &c. (this is the common mode of multiplication used in horticulture). A callus forms over the wound, and in it there develops a meristem which gives rise to one or more buds.

The infl. is axillary, dichasial with a bostryx tendency (p. 52). The first axes usually end in  $\sigma$ , the last and sometimes the last but one in  $\varphi$ , flrs. In the  $\sigma$ , perianth 2, valvate, or 4, decussate, corolline; sta.  $\infty$ , free or not, the connective often elongated and the anthers variously shaped. In the  $\varphi$ , perianth 2-5; ovary inf., usually (2-3), with 2-3 loculi, and axile placentae often projecting far into them; ovules  $\infty$ , anatropous; styles more or less free. The ovary is usually winged and the wings are persistent upon the capsular frt. Seeds without endosperm.

**Begoniaceae**. Dicotyledons (Archichl. Parietales). 4 gen. with the characters of *Begonia* (*g.v.*). Placed in Passiflorales by Warming, in Passiflorales by Benth.-Hooker.

**Bellis** (Tourn.) Linn. Compositae (III). 10 sp. Eur., Medit. *B. perennis* L. is the common daisy. It multiplies largely, and also hibernates, by means of short rhizomes. The ray florets are  $\varphi$ . The head closes at night and in wet weather.

**Bellium** Linn. Compositae (III). 6 sp. Medit.

**Bencomia** Webb. et Berth. Rosaceae (III. 9). 2 sp. Canaries, Madeira (p. 158).

**Benincasa** Savi. Cucurbitaceae (III). 2 sp. trop. As. The frt. of *B. cerifera* Savi. is eaten in curries. It has a thick coating of wax.

**Benthamia** Lindl. (1830) = *Amsinckia* Lehm.; (1833) = *Cornus* Tourn.

**Bentinckia** Berry. Palmae (IV. 6). 2 sp. Ind.

**Benzoin** Nees = *Lindera* Thunb. *do.* Hayne = *Styrax* Linn.

**Berberidaceae.** Dicotyledons (Archichl. Ranales). 11 gen. with 135 sp., N. temp. (*Berberis* in trop. Mts. and S. Am.). Perennial herbs or shrubs, in the former case usually with sympodial rhizome. Flrs. in racemes, 7, regular. The typical formula is  $P\ 3+3+3+3$ ,  $A\ 3+3$ ,  $\underline{G}\ 1$ ; the flr. is sometimes 2-merous. Of the 4 outer whorls, the two outer are perianth proper, the two inner "honey-leaves" usually with nectaries at the base (see Ranunculaceae). The former are often termed the calyx, the latter the corolla. The anthers are introrse, but in most cases open by two valves (cf. Lauraceae) at the back; the valve with the pollen on it moves upwards and turns round so that the pollen faces towards the centre of the flr. Cpl. always 1, with one or many ovules, in the former case usually basal, in the latter ventral. Fruit a berry, or a dry fruit opening in various ways. Embryo straight in rich endosperm. *Chief genera:* *Podophyllum*, *Epimedium*, *Leontice*, *Berberis*. Placed in Polycarpiceae by Eichler (Warming). See next art.

**Berberideae** (Benth.-Hook.) includes preceding order and Lardizabalaceae. Placed in coh. Ranales.

**Berberis** (Tourn.) Linn. Berberidaceae. 100 sp. N. temp., Andes, S. Am. *B. vulgaris* L. (the barberry) in Brit. Shrubs. The genus is divided into two sections. In § 1, *Mahonia* (Nutt.), the leaves are pinnate; many sp. are cultivated in shrubberies. In § 2, *Euberberis*, the leaves are simple, but usually show a joint where the blade meets the petiole, seeming to indicate a derivation from a compound leaf. There are also 'short' and 'long' shoots (cf. Coniferae) in this section, to which *B. vulgaris* belongs. The latter have their leaves metamorphosed into spines (usually tripartite); transitions may often be seen. The former stand in the axils of the spines and bear green leaves and racemes of flrs. (afterwards sometimes elongating to 'long' shoots). The flr. has the structure typical of the order; its pollination mechanism is interesting. The upper surface of the base of each sta. is sensitive to contact, and when it is touched by an insect in search of honey (secreted by the nectaries upon the bases of the inner perianth leaves) the sta. springs violently upwards, covering the side of the visitor's head with pollen, which it may place on the stigma in the next flr. visited. The fruit is sometimes made into preserves.

A very interesting point about the common barberry is its connection with the disease known as *rust*, which occurs on wheat and other

Gramineae. The fungus (*Puccinia graminis* or *Aecidium berberidis*) passes through two alternating stages in its life history, one on the grass, the other on the barberry, so that if there are no barberry plants in a district, it is practically insured against rust. See text-books, or Ward's *Diseases of Plants*.

**Bergenia** Moench. = Saxifraga Tourn. (7 sp. As.)

**Berkheya** Ehrh. Compositae (X). 70 sp. Afr.

**Bernoullia** Oliv. Sterculiaceae. 1 sp. Guatemala.

**Berrya** Roxb. Tiliaceae. 2 sp. Ceylon, E. Ind., Tahiti.

**Berteroia** DC. = Alyssum Tourn. (5 sp. Eur., As., Medit.)

**Bertholletia** Humb. et Bonpl. Lecythidaceae. 2 sp. trop. S. Am.

The frt. is a large woody capsule, containing seeds with hard woody testa and oily endosperm—the Brazil nuts of commerce. "This tree takes more than a year to produce and ripen its fruits. In.. January I observed the trees loaded at the same time with flowers and ripe fruits.... The fruits, nearly as hard and heavy as cannon-balls, fall with tremendous force from the height of 100 feet.... Persons are sometimes killed by them" (Wallace). The fruit is indehiscent and the seeds are procured by opening it with an axe.

**Bertolonnia** Raddi. Melastomaceae (1). 9 sp. S. Brazil. Young plants form readily at cuts across the midrib of a leaf placed on damp soil (p. 115).

**Beschorneria** Kunth. Amaryllidaceae (11). 13 sp. Mex. Like Agave.

**Besleria** Plum. Gesneraceae (1). 50 sp. trop. and sub-trop. Am.

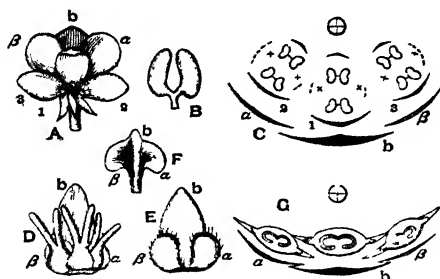
**Bessera** Schult. f. (excl. *Androstephium* Torr.). Liliaceae (IV). 1 sp. Mex.

**Beta** (Tourn.) Linn. Chenopodiaceae (2). 6 sp. Eur., Medit.; 1 in Brit., *B. vulgaris* L. or *B. maritima* L. the sea-beet, from which are derived the garden beetroot, the sugar-beet, and the mangold-wurzel. The plant is a biennial (p. 161) and stores reserves in the root, the non-nitrogenous materials taking the form of sugar. The sugar-beet is largely cultivated in Western Europe for the sake of this sugar. The garden beet is a favourite vegetable; the mangold is valuable for feeding cattle, &c. The leaves are sometimes eaten like spinach.

**Betonica** (Tourn.) Linn. = Stachys Tourn.

**Betula** (Tourn.) Linn. Betulaceae. 35 sp. N. temp. *B. alba* L., the birch, is common in Brit. and reaches to the N. limit of trees (p. 197). Trees with catkins of flrs. The ♂ catkins are laid down in autumn as large buds at the end of the year's growth, the ♀ further back, on leafy branches. In the axil of each leaf of the catkin there are 3 flrs. (cf. other genera of the order). The bracts of the lateral flrs. occur ( $\alpha$ ,  $\beta$ ) but no bracteoles. In the ♂ the bracteoles  $\alpha$   $\beta$  are joined to the bract itself. Each flr. has two sta. and a perianth, often reduced from the typical 4 leaves to the 2 median leaves, or even to the single anterior leaf. The sta. are divided into halves nearly to the base; the lateral ones are absent. In the ♀ the bracteoles  $\alpha$   $\beta$

are free from the bract at the time of fertilisation, but afterwards they unite with it to form the 3-lobed woody scale (*F* in figure) under the



*B. alba* A, bract, bracteoles, and perianth, of ♂, from within, with sta. removed, B, a stamen, C, floral diagram of A, D, bract, bracteoles and flrs. of ♀ from within, E, the same with flrs. removed, F, the same at ripeness of seed, G, floral diagram of D. *b*=bract, *a*, *β*=bracteoles of flr. 1, or bracts of flrs. 2, 3. After Eichler.

fruit (or rather the tissue beneath them grows up, carrying all up together; see p. 34). The 2-locular ovary gives rise to a 1-seeded nut, attached to the scale. There is no perianth.

Birch-wood is tough and is used for various purposes, e.g. for wooden shoes and for charcoal. The oil prepared from the bark is used in tanning Russia leather, to which it gives its peculiar fragrance. The bark of *B. papyracea* Ait. (N. Am.) is used in making canoes.

**Betulaceae.** Dicotyledons (Archichl. Fagales). 6 gen. with 75 sp., chiefly N. temp. Shrubs or trees with undivided stipulate leaves. The seedling stems are radial in symmetry, but in the old branches the leaves are often 2-ranked and face upwards (p. 38). The membranous stipules soon drop off. Flrs. monœcious, in terminal catkins; the stem is thus sympodial. In the axils of the leaves of the catkins are small dichasial cymes, typically of 3 flrs. (see *Betula*, &c.). The central flr. is often absent, and some of the bracteoles also. The ♂ flr. is united to the bract and may have a perianth; sta. 2—10. The ♀ may have an epigynous perianth. Cpls. (2). Ovary inferior, 2-loc. with 1 pendulous ovule in each loc. Some genera are chalazogamic; see Chalazogamæ. Nut 1-seeded; seed exalbuminous. After fertilisation the bract and bracteoles grow into a scale- or cup-like organ which may remain attached to the fruit. *Genera*—*Ostryopsis*, *Carpinus*, *Ostrya*, *Corylus*, *Betula*, *Alnus*. The order is placed in Quercifloræ by Eichler, and united to Fagaceæ (Cupulifloræ) by Benth.-Hooker.

**Biarum** Schott. Araceæ (VII). 7 sp. Medit.

**Bicarpellatae** (Benth.-Hooker). The 3rd series of Gamopetalæ (p. 144).

**Bicornes** (Warming). The 1st cohort of Sympetalae (p. 146).

**Bidens** (Tourn.) Linn. Compositae (v). 90 sp. cosmop. 2 in Brit. (bur-marigold). The fruit is animal-distributed by aid of the 2-6 barbed bristles of the pappus. *B. Beckii* Torr. (N. Am.) is a water-plant with two kinds of leaves (p. 173).

**Biebersteinia** Steph. Geraniaceae. 4 sp. Orient.

**Bifrenaria** Lindl. Orchidaceae (18). 10 sp. trop. S. Am.

**Bigelowia** DC. Compositae (111). 34 sp. N. Am.

**Bignonia** (Tourn.) Linn. (incl. *Cremastus* Miers, *Cydista* Miers, *Doan-  
antha* Miers, *Paragonia* Bur., *Phaedranthus* Miers, *Pleonotoma*  
Miers, *Pyrostegia* Presl., *Stizophyllum* Miers, all regarded as in-  
dependent genera by Schumann in *Nat. Pfl.*). Bignoniaceae (1).  
150 sp. Am., mostly lianes. In *B. Tweediana* Lindl. the tendril is  
grapel-like with three sharp claws. The stem twines, and both  
petioles and tendrils are sensitive to contact. When either curves  
round the support, the claws catch hold of their own stalk or the  
stem as they come round. After clasping the tendril thickens and  
becomes woody. In *B. capreolata* L. the tendrils are bluntly hooked  
and show great negative heliotropism. When the tip enters a crevice  
it forms a ball of parenchyma, secreting cement (cf. *Vitis*). Then  
the free part contracts spirally and becomes woody. Several sp. are  
cultivated for their showy protandrous flrs.

**Bignoniaceae**. Dicotyledons (Sympet. Tubiflorae). About 60 gen.  
with 500 sp. trop. There are no sp. and only one genus (Catalpa)  
common to the old and new worlds. Most occur in Brazil; a few  
are found in temp. regions. They are trees and shrubs, most com-  
monly lianes, with opp. usually compound exstip. leaves. A con-  
siderable number are xerophytic shrubs with condensed stems, but  
the chief interest of the order centres in the climbers, which form a  
very important feature in the forest vegetation of S. Am. There are  
twiners (e.g. *Tecomaria*, *Pandorea*), root-climbers (*Tecoma radicans*),  
and tendril climbers (most B.). In *Eccremocarpus* &c. the inter-  
nodes and petioles are sensitive, but in most B. the tendrils are at  
the ends of the leaves (in place of leaflets, as in *Vicia*). The tendrils  
are frequently branched: in some cases, e.g. *Bignonia*, the branched  
tendril occupies the place of one leaflet. Three types of tendril are  
found—simple twiners, tendrils provided with adhesive discs (as in  
*virginia creeper*), and hooked tendrils. See *Glaziovina*, *Bignonia* &c.  
The climbing stems exhibit many features of anatomical interest,  
owing to their peculiar growth in thickness (p. 178).

Infl. usually dichasial with cincinnal tendency (p. 52); bracts  
and bracteoles present. Flr. ♂, zygomorphic, hypogynous. K (5):  
C (5), usually bell- or funnel-shaped, descendingly imbricate; A 4,  
epipetalous, didynamous, the anther-lobes usually one above the  
other, the posterior staminode always present.  $\bar{C}$  (2) on hypogynous  
disc, 2- (or rarely 1-) loc., with  $\infty$  erect anatropous ovules on axile

placentae. Capsule septifragal or loculicidal: seed usually flattened and with large membranous wing, exalbuminous.

*Classification and chief genera* (after Schumann):

- I. *BIGNONIEAE* (ovary completely 2-loc., compressed || septum, or cylindrical; capsule septifragal, with winged seeds; usually tendrillate): *Glaziovina*, *Bignonia*.
- II. *TECOMAEAE* (ovary 2-loc., compressed 1 septum or cylindrical; capsule loculicidal with winged seeds; rarely tendrillate): *Incarvillea*, *Jacaranda*, *Catalpa*, *Tecoma*.
- III. *ECCREMOCARPEAE* (ovary 1-loc.; capsule splits from below upwards; seeds winged; tendrils): *Eccremocarpus* (only gen.).
- IV. *CRESCENTIEAE* (ovary 1- or 2-loc.; fruit berry or dry indehiscent; seeds not winged; usually erect plants): *Crescentia*, *Phyllarthron*.
- V. *TOURRETTIEAE* (ovary 4-loc.; hooked capsule): *Tourrettia* (only gen.).

The order is placed in Personales by Benth.-Hooker, in Personatae by Eichler (Warming).

**Billardiera** Sm. Pittosporaceae. 8 sp. Austr.

**Billbergia** Thunb. Bromeliaceae (1). 40 sp. trop. Am. Epiphytes.

**Biophytum** DC. Oxalidaceae. 20 sp. trop. *B. sensitivum* DC. has pinnate leaves, sensitive to contact (cf. *Mimosa*). When touched the leaflets bend downwards. The seed has an explosive aril (cf. *Oxalis*); the capsule spreads out flat when it dehisces and thus allows the seeds to escape easily.

**Blota** D. Don. = *Thuja* Linn. (all sp. of *B.* = *T. orientalis*).

**Biscutella** Linn. Cruciferae (11. 5). 12 sp. Eur.

**Biserrula** Linn. Leguminosae (111. 6). 1 sp. Medit. The frt. is very like a centipede, and it has been suggested that birds are deceived by it and carry it to a distance before discovering their mistake.

**Bismarckia** Hildebr. et H. Wendl. Palmae (11. 3). 1 sp. Madag. Included in *Medemia* in *Nat. Pf.*

**Bixa** Linn. Bixaceae. 1 sp., *B. Orellana* L., trop. Am. Cultivated all over the Tropics for its seed. The outer layer of the testa is red and fleshy; the orange-yellow colouring matter (annatto, arnotto, &c.) is used in dyeing sweetmeats &c.

**Bixaceae**. Dicotyledons (Archichl. Parietales). 4 gen. with 19 sp., trop. Small trees or shrubs, sometimes with tuberous underground stem; leaves alt., stipulate, usually large and lobed. Schizogenous mucilage canals are present in the tissues, and resin cells in the leaf parenchyma in most sp. Flrs. in panicles, ♂, regular. K 4—5, imbricate; C 4—5, imbricate or convolute; A ∞, sometimes united at base, the anthers usually opening by short slits or pores;  $\bar{G}$  (2—5), 1-loc. with parietal placentae, or more or less completely multi-loc. by union of the placentae in the centre. Ovules ∞, anatropous. Style

simple. Frt. a capsule; seeds  $\infty$  with rich endosperm; embryo usually curved. As defined by Warburg in *Nat. Pfl.* this order consists of the 4 gen. *Bixa*, *Cochlospermum*, *Amoreuxia*, and *Sphaerosepalum*. The latter was formerly placed in *Guttiferae*. B. are placed in *Cistiflorae* by Warming (Eichler), and in *Parietales* by Benth.-Hooker. These authors all include in B. the *Flacourtiaceae*, treated as a separate order by Engler.

**Birineae** (Benth.-Hooker) = *Bixaceae* (in wide sense; see above).

**Blackstonia** Huds. = *Chlora* Ren.

**Blaeria** Linn. *Ericaceae* (IV. 9). 15 sp. Afr.

**Blakea** P. Br. *Melastomaceae* (I). 30 sp. S. Am., W. Ind.

**Blandfordia** Sm. *Liliaceae* (III). 4 sp. E. Austr.

**Blatti** Adans. = *Sonneratia* Linn. f.

**Blattiaceae**. *Dicotyledons* (Archichl. *Myrtiflorae*). 3 gen. with 12 sp., Old World trop. They are united to *Lythraceae* by Benth.-Hooker, but differ in the ovary, which is usually united to the receptacle and has parietal or sub-basal placentae. Chief genus *Sonneratia* (Blatti).

**Blechnum** Linn. *Polypodiaceae*. 20 sp. trop. and temp. The British fern *B. boreale* Sw. or *B. Spicant* Roth. = *Lomaria* S. Desv.

**Blepharipappus** Hook. *Compositae* (V). 1 sp. W. N. Am.

**Blepharis** Juss. *Acanthaceae* (IV. B). 40 sp. trop. and sub-trop., Old World. Thistle-like plants with the characters of *Acanthus*. The seeds have hairs which swell up when wetted.

**Bletia** Ruiz et Pav. *Orchidaceae* (15). 20 sp. trop. Am. Epiphytes. For *B. hyacinthina* R. Br. see next art.

**Bletilla** Reichb. f. *Orchidaceae* (5). 1 sp. China, Japan.

**Blighea** Kon. *Sapindaceae* (I). 1 sp. trop. Afr., *B. sapida* Kon., cultivated for its frt. The edible part is the fleshy arillate seed-stalk.

**Bloomeria** Kellogg. *Liliaceae* (IV). 2 sp. Calif.

**Blumea** DC. *Compositae* (IV). 60 sp. trop. and sub-trop., Old World.

**Blumenbachia** Schrad. (incl. *Caiophora* Presl.). *Loasaceae* (III). 55 sp. S. Am. The flr. is like that of *Loasa*. The frt. is twisted and is very light. It is covered with grapnel hairs and clings closely to fur; as it is carried about the seeds are gradually shaken out.

**Blysmus** Panz. = *Scirpus* Tourn.

**Bobartia** Linn. *Iridaceae* (II). 6 sp. S. Afr. Leaves sword-like, or centric like those of onions.

**Bocconia** Plum. (incl. *Macleaya* Reichb.). *Papaveraceae* (II). 3 sp., 2 in trop. Am., the other, *B. (M.) cordata* Willd., in China and Japan. Flr. apetalous.

**Boehmeria** Jacq. *Urticaceae* (3). 45 sp. trop. and N. temp. *B. nivea* Gaudich. has good "drip-tips" on its leaves (see art. *Ficus*). It is largely cultivated in China for the excellent fibre (Rhea or Chinese grass-cloth) obtained from the inner bark (cf. *Linum*).

**Boerhaavia** Vaill. *Nyctaginaceae* (I). 20 sp. Afr., trop. As., Am. The anthocarp is often glandular, aiding in seed-distribution.

## BORAGINACEAE

**Bolbophyllum** Spreng = *Bulbophyllum* Thou

**Boldoa** Endl = *Peumus* Molina

**Boltonia** L'Herit. Compositae (III). 3 sp U S.

**Bomarea** Mirb. Amaryllidaceae (III). 50 sp S Am Like *Alstroemeria* in leaf and flr, but often climbing Umbels cymose

**Bombacaceae.** Dicotyledons (Archichl. Malvales) 20 gen with 110 sp trop (chiefly Am) Trees, often very large, with thick stems, sometimes egg shaped, owing to a great development of water storage tissue (see figs in Kerner, *Nat Hist of Plts* 1) Flrs. ♂, usually regular K (5), valvate, often with epicalyx; C 5, convolute, the petals asymmetric, A 5—∞, free or united into a tube, the pollen smooth, G (2—5), in the latter case the cpls opposite the petals, multi-loc, style simple, lobed or capitate, ovules 2—∞ in each loc, erect, anatropous Seeds smooth, but often embedded in hairs springing from the capsule wall, with little or no endosperm The order is united to Malvaceae by Eichler (Warming) and Benth Hooker

*Chief genera* *Adansonia*, *Bombax*, *Ernodendron*, *Durio*

**Bombax** Linn (excl *Pachira* Aubl) Bombacaceae 50 sp trop

**Bonatea** Willd = *Habenaria* Willd

**Bongardia** C A Mey. Berberidaceae 1 sp Greece to Cent As

**Bontia** Linn Myoporaceae 1 sp W Ind

**Boopis** Juss Calyceraceae 10 sp S Am

**Boraginaceae** Dicotyledons (Sympet Tubiflorae) About 85 gen with 1200 sp, trop and temp, esp Medit Most are herbs, perennial by fleshy roots rhizomes, &c, a few shrubs and trees Leaves usually alt, exstip, generally, as well as the rest of the plant, covered with stout hairs (hence the name *Asperifoliae*, by which the B are sometimes known) The infl is a coiled cincinnus, sometimes double, with a marked dorsiventrality As the flrs open it uncoils, so that the newly opened flrs face always in the same direction (the morphology of this infl is very imperfectly understood, "adnation" occurs, and dichotomy at the growing apex, see *Nat Pfl* &c).

Flr ♂, usually regular, hypogynous, and 5 merous K (5), imbricate or open, the odd sepal posterior, C (5), funnel shaped or tubular, the limb usually flat, A 5, epipet, alternate to petals, anthers introrse, G (2), on hypogynous disc, 4 locular by 'false septum' (see Labiatae), usually with gynobasic style ovules 1 in each loc, erect, anatropous. Fruit a drupe or 4 achenes. Seed with straight or curved embryo in slight endosperm, the radicle directed upwards

The floral arrangements are interesting. Most B have a short tube, partly concealing the honey, many (esp 14 1 and 3) have scales projecting inwards from the throat of the corolla, thus fully concealing the honey, protecting it from robbery and narrowing the entrance, so that visiting insects must take a definite track. "The lower forms (e.g. *Myosotis*) are visited by flies (esp Syrphidae), bees, and Lepidoptera, and are adorned with red, violet and blue colours.



...Many sp., in the course of their individual development, seem to recapitulate to us the evolution of their colours—white, rosy, blue in several sp. of *Myosotis*; yellow, bluish, violet in *M. versicolor*; and red, violet, blue in *Pulmonaria*, *Echium* &c. Here, white and yellow seem to have been the primitive colours; and, at least in many cases, violet and blue seem to have been preceded by red—an assumption which is strengthened by the fact that many blue and violet sp. (*Myosotis*, *Anchusa*, *Symphytum*) give us white and rose-red varieties, apparently by reversion to more primitive characters." (Müller.)

Many B. are heterostyled, e.g. *Pulmonaria*. The fls. of many sp. are pendulous (and thus bee-flowers), e.g. *Borago*, *Symphytum*. *Echium* is gynodioecious.

*Classification and chief genera* (after Gurke):

A. Style terminal: drupe.

I. *CORDIOIDEAE* (style twice bi-lobed): *Cordia*.

II. *EHRETIOIDEAE* (style simple or bi-lobed or double; no ring of hairs): *Ehretia*.

III. *HELIOTROPIOIDFÆ* (ditto, but ring of hairs near tip of style): *Tournefortia*, *Heliotropium*.

B. Style gynobasic: achenes.

IV. *BORAGINOIDEAE*:

a. Achenes 4.

1. *Cynoglosseae* (fl. reg.; base of style more or less conical; tips of achenes not projecting above pt. of attachment): *Omphalodes*, *Cynoglossum*, *Rindera*.

2. *Eritrichieae* (do., but tips projecting above pt. of attachment): *Echinosperrum*, *Eritrichium*, *Cryptanthus*.

3. *Anchuseae* (fl. reg.; base of style flat or slightly convex; achenes with concave attachment surface): *Symphytum*, *Borago*, *Anchusa*, *Alkanna*, *Pulmonaria*.

4. *Lithospermeae* (do., but surface of attachment flat): *Myosotis*, *Lithospermum*, *Arnebia*, *Cerinthus*.

5. *Echieae* (fl. zygomorphic): *Echium*.

b. Achenes more or less than 4.

6. *Harpagonelleae* (ach. 2): *Harpagonella*, *Rochelia* (only gen.).

7. *Zoellerieae* (ach. 10): *Zoelleria* (only gen.).

[Placed in *Nuculiferae* by Eichler (Warming), in *Polemoniales* by Benth.-Hooker.]

**Boragineae** (Benth.-Hooker) = *Boraginaceae*.

**Borago** Linn. *Boraginaceae* (iv. 3). 3 sp. *Medit., Eur., As.* *B. officinalis* L. in Brit. The borage is largely cultivated for bee feeding. It has a typical bee-flower. The blue pendulous fl. secretes honey below the ovary; the elastic sta. form a cone and dehisce introrsely from apex to base, the pollen ripening gradually and trickling into the tip of the cone. Insects probing for honey dislocate the sta.,

receiving a shower of pollen (cf. *Erica*, *Galanthus*, *Cyclamen*). In older flowers the stigma, now ripe, projects beyond the sta. so as to be touched first.

**Borassus** Linn. Palmae (II. 3). 1 sp., *B. flabellifer* L., the Palmyra palm, in trop. Afr. and As. Dioecious. Its uses are legion; an old Tamil song enumerates 801! The chief is perhaps the production of palm-wine or toddy, obtained by tapping the sap flowing to an infl. (cf. *Agave*), and fermenting it.

**Borbonia** Linn. Leguminosae (III. 3). 13 sp. S. Afr.

**Boretta** Neck. = *Dabeocia* D. Don.

**Boronia** Sm. Rutaceae (III). 60 sp. Austr.

**Borreria** G. F. W. Mey. = *Spermacoe* Linn.

**Bossiaea** Vent. Leguminosae (III. 3). 34 sp. Austr. Several xerophytic sp. have flattened green stems (phylloclades) with minute scaly leaves. As in *Acacia* &c., seedlings show transitions from normal leaves.

**Boswellia** Roxb. Burseraceae. 10 sp. India, Afr. *B. Carteri* Birdw. (Somaliland and Hadramaut) yields the resin known as frankincense or gum-olibanum, obtained by notching the stem. It was formerly officinal, but is now chiefly used in incense. Other sp. also yield fragrant resins.

**Botrychium** Sw. Ophioglossaceae. 6 sp. temp. and trop. *B. Lunaria* Sw., the moon-wort, is found in many places in Britain, but not abundantly. The general habit resembles that of *Ophioglossum*, but the sterile as well as the fertile part of the leaf is usually branched. The roots appear one at the base of each leaf, and branch monopodially. The spike is usually much branched, the ultimate twigs being the sporangia.

**Boucerosia** Wight et Arn. Asclepiadaceae (II. 4). 20 sp. Medit., trop. Afr. and As. Like *Stapelia*. Included in *Caralluma* R. Br. in *Nat. Pfl.*

**Bougainvillea** Comm. Nyctaginaceae (I). 7 sp. S. Am. The group of 3 flrs. is surrounded by 3 lilac-coloured bracts, which persist and act as wings for the fruits.

**Boussingaultia** H. B. et K. Basellaceae. 10 sp. trop. Am.

**Bouteloua** Lag. Gramineae (X). 30 sp. S.-West U. S., the mezquit grasses, which form a large portion of the herbage of the prairie, and are valuable as fodder.

**Bouvardia** Salisb. Rubiaceae (I. 4). 30 sp. trop. Am. Some are heterostyled like *Primula*. Often cultivated for their flrs. •

**Bowenia** Hook. Cycadaceae. 1 sp. Queensland. Easily recognised by its bipinnate leaf (see order).

**Bowiea** Harv. Liliaceae (III). 1 sp. Cape Col., *B. volubilis* Harv. It is a xerophyte like *Testudinaria*, with a large partly underground stock (corm), giving off each year a much-branched climbing stem. This bears small leaves, but they soon drop off, and assimilation is carried on by the green tissue of the stem.

**Bowlesia** Ruiz et Pav. Umbelliferae (2). 12 sp. Am., Canary Is.

**Boykinia** Nutt. Saxifragaceae (1). 7 sp. N. Am., Japan.

**Brachycome** Cass. Compositae (III). 50 sp. Austr., N. Z., N. Am., Afr.

**Brachypodium** Beauv. Gramineae (x). 6 sp. temp. (and trop. Mts.). 2 in Brit. (false brome grass). Leaf reversed (cf. *Alstroemeria*).

**Brachysema** R. Br. Leguminosae (III. 2). 14 sp. Austr.

**Bradburya** Rafin. = *Wistaria* Nutt. and *Centrosema* Benth.

**Brahea** Mart. Palmae (1. 2). 2 sp. Mexico, Texas.

**Brainea** Hk. Polypodiaceae. 1 sp. Hong-kong and Khasia, *B. insignis* Hk., a dwarf tree-fern. The primary veins branch and rejoin repeatedly, forming small areas in the leaf; the veinlets run parallel and distinct.

**Brasenia** Schreb. Nymphaeaceae (II). 1 sp. cosmop., except Eur. Sta. 12 or more.

**Brassavola** R. Br. Orchidaceae (13). 20 sp. trop. Am.

**Brassia** R. Br. Orchidaceae (18). 30 sp. trop. Am.

**Brassica** (Tourn.) Linn. (incl. *Erucastrum* Presl. and *Sinapis* L.).

Cruciferae (II. 10). 85 sp. Eur., Medit., As. 7 in Brit. Many forms of this genus are cultivated, some for the flr., others for the stem, root, leaf, or seed. *B. (S.) nigra* Koch is the black mustard, whose ground seeds form the familiar condiment; *B. (S.) alba* Boiss. is the white mustard, used when young in salads &c.; *B. sinapis* Vis. (*S. arvensis* L.) is the charlock, one of the most abundant weeds of cultivation (in summer our corn-fields are yellow with it). *B. oleracea* L. is the cabbage, with the various races derived from it, such as cauliflower and brocoli (fleshy infl.), kale, brussels-sprouts (a form in which miniature cabbages are produced in all the leaf-axils on the main stem), kohl-rabi (a thickened stem, or corm, showing leaf scars on its surface), &c. *B. campestris* L. is the turnip, a biennial with thickened root, and a variety of it—*B. Napus* L.—is the rape, used in salads and in the preparation of rape- or colza-oil, expressed from the seeds. [See De Candolle's *Orig. of Cultiv. Plts.*] It is of interest to notice here the great variety of morphology in the vegetative organs, correlated with the different ways in which storage of reserve materials is effected, in the root, stem, leaf, flowerstalk &c.

The outer coat of the seed has mucilaginous cell-walls which swell when wetted and help to fasten the seed to its place of germination (cf. *Linum*).

**Bravoa** Lex. Amaryllidaceae (II). 3 sp. Mexico. Rhizome with tuberous roots. Flr. zygomorphic by bending.

**Braya** Sternb. et Hoppe. Cruciferae (IV. 18). 8 sp. Mts. of Eur., As.

**Brevoortia** Wood. Liliaceae (IV). 1 sp. Calif.

**Breweria** R. Br. Convolvulaceae (1. 2). 27 sp. trop.

**Brexia** Noronha. Saxifragaceae (V). 1 sp. Madag., Seychelles.

**Brickellia** Ell. Compositae (II). 60 sp. trop. and sub-trop. Am.

**Bridelia** Willd. Euphorbiaceae (A, 1. 2). 30 sp. trop., W. Afr. to New Caled.

**Bridgesia** Hook. et Arn. = *Ercilla* A. Juss.

**Briza** Linn. Gramineae (x). 12 sp. temp. 2 in Brit. (*B. media* L., and *B. minor* L., quake-grasses).

**Brocchinia** Schult. f. Bromeliaceae (2). 3 sp. trop. Am. & W. Ind.

**Brodiaea** Sm. (incl. *Calliprora* Lindl.). Liliaceae (iv). 30 sp. Am. west of Mts.). Flrs. in cymose umbels. The sta. have curious projecting appendages; in *B. ixioides* S. Wats. (*C. lutea* Lindl. or *flava* Hort.) these are covered with turgid cells, which rupture when touched by any hard body, allowing a honey-like fluid to escape (*Linn. Soc. Journ.* xxx. p. 285).

**Bromelia** Plum. Bromeliaceae (1). 4 sp. W. Ind. and Brazil.

**Bromeliaceae.** Monocotyledons (Farinosae). 40 gen. with 400 sp. trop. Am. Many are terrestrial plants (xerophytes, living on rock. &c.), but the bulk of the sp., by virtue of their good seed-distribution and their xerophytic habit, have become epiphytes, forming a very characteristic feature in the vegetation of the forests of the Amazon &c., more so in fact than the orchids, which they surpass in number of individuals though not of sp. Most of them have a very reduced stem, bearing a rosette of fleshy leaves channelled on the upper surface and fitting closely together by their bases, so that the whole plant forms a kind of funnel, which is usually full of water. In this are to be found dead leaves, decaying animal matter and other débris (in Venezuela certain sp. of *Utricularia* live only in these pitchers). There are a number of adventitious roots which fasten the plant to its support, but which do not aid in its nutrition, or at least very little. The bases of the leaves are covered with peculiar scaly hairs by which the water in the pitcher is absorbed. Water is stored in the leaves, whose bulk consists largely of water-tissue. They have a thick cuticle and often bear scaly hairs that aid in reducing transpiration. Some sp. show a totally different habit to this, e.g. *Tillandsia usneoides* (g.v.). [See p. 184 and paper by Schimper there referred to.]

The infl. usually rises out of the centre of the pitcher and has as a rule brightly coloured bracts adding to the conspicuousness of the flrs. Flr. usually ♂, regular, 3-merous. Perianth 3+3 or (3)+(3), the outer whorl sepaloid, persistent, the inner petaloid; A 6, introrse, often epipet.; G (3), inf., semi-inf., or sup., 3-loc., with ∞ anatropous ovules on the axile placentae in each. Style 1, with 3 stigmas. Frt. a berry or capsule; seeds in the latter case very light, or winged. Embryo small, in mealy endosperm.

*Classification and chief genera* (after Wittmack):

1. *Bromeliaceae* (berry; ovary inf.; leaf with thorny teeth):  
*Bromelia*, *Ananas*, *Billbergia*, *Aechmea*.

2. *Pitcairniae* (capsule; ovary semi-inf. or almost sup.; leaf entire, or toothed at base, rarely at top): *Pitcairnia*.
3. *Puyae* (capsule; ovary sup.; leaf thorny; usually large stem): *Puya*, *Dyckia*.
4. *Tillandsiae* (do., but leaf entire; seed hairy): *Tillandsia*.

[Placed in Epigynae by Benth.-Hooker, in *Liliiflorae* by Eichler (Warming).]

**Bromus** Dill. Gramineae (x). 45 sp. temp., and trop. Mts. 7 in Brit. (brome-grass). Though so common, they are of no value as pasture grasses.

**Brosimum** Sw. Moraceae (II). 8 sp. trop. Am. The infl. is remarkable (fig. in *Nat. Pfl.*), consisting of a spherical pseudo-head composed of one ♀ flr. and many ♂ flrs. The former is sunk into the centre of the common receptacle, and its style projects at the top, whilst the latter occupy the whole of the outer surface. Each ♂ flr. has a rudimentary perianth and one sta., whose versatile anther dehisces in a curious way, passing from a shape somewhat like  $\overline{\text{T}}$  to one like  $\overline{\text{Z}}$ . The achene is embedded in the fleshy receptacle.

The achene of *B. Alicastrum* Sw. is the bread-nut (not to be confused with *Artocarpus*, the bread-fruit), which is cooked and eaten in the W. Ind., &c. *B. Galactodendron* D. Don. is the cow-tree or milk-tree of Venezuela. When a notch is cut in the stem, the milky latex flows out in considerable quantities; it tastes very like ordinary milk and is used for the same purposes. The wood of several sp. is useful, though liable to split.

**Broussonetia** L'Hérit. Moraceae (I). 3 sp. E. As. Dioecious; ♂ flrs. in pseudo-racemes, with explosive sta. like those of *Urtica* (unusual in this order); ♀ flrs. in pseudo-heads. Multiple frt. (cf. *Morus* &c.). *B. papyrifera* Vent. is the Paper-mulberry of Japan. Paper is made from the inner bark (see *Treas. of Bot.*); in Polynes. the natives make cloth from it (tapa or kapa cloth).

**Browallia** Linn. Solanaceae (v). 6 sp. trop. Am.

**Brownea** Jacq. (*Hermesias* Loeffl.). Leguminosae (II. 3). 10 sp. trop. Am., W. Ind. The young shoots hang down and their leaves are red (p. 167). The flrs. in some sp. are borne on old wood (p. 167).

**Bruckenthalia** Reichb. Ericaceae (IV. 9). 1 sp. S. E. Eur.

**Brugmansia** Blume. Rafflesiaceae. 3 sp. Malay Arch.

do. Pers. = *Datura* Linn.

• **Bruguiera** Lam. Rhizophoraceae. 5 sp. trop. As., Afr., Austr. One of the trees of the mangrove-formation (p. 188). Like *Rhizophora* but without the aerial roots from the higher branches. The roots in the mud give off erect aerating branches, as in *Sonneratia* &c.

**Brunella** Tourn. = *Prunella* Linn.

**Brunfelsia** Plum. Solanaceae (v). 22 sp. trop. Am.

**Bruniaceae**. Dicotyledons (Archichl. Rosales). 12 gen. with 50 sp. Cape Col. Heath-like shrubs, with alt., exstip. leaves and racemose

- infl. Flr. ♂, usually regular, 5-merous, generally perigynous. Sta. in one whorl. Cpls. (3—2) each with 3 or 4 ovules, or 1 with 1 ovule. Capsule with 2, or nut with 1, seeds. Aril. Endosperm. Placed in Rosales by Benth.-Hooker. Rarely seen in Eur. [See *Nat. Pfl.*]
- Brunonia** Sm. Goodeniaceae. 1 sp. Austr., Tasm. It differs from the other *G.* very much (see order) and is sometimes classed as a separate order.
- Brunsvigia** Heist. Amaryllidaceae (1). 9 sp. S. Afr.
- Brya** P. Br. Leguminosae (III. 7). 3 sp. Cent. Am., W. Ind. *B. Ebenus* DC. yields the wood known as Jamaica or American Ebony.
- Bryanthus** S. G. Gmel. Ericaceae (1. 3). 6 sp. N. W. Am., one of which, *B. taxifolius* A. Gray, is circumpolar (incl. Brit.).
- Bryonia** Linn. Cucurbitaceae (III). 8 sp. Eur., As., Afr. *B. dioica* Jacq. is our common white bryony, which marks the N. limit of the order in Eur. The ♂ flr. is about twice as large as the ♀. Honey is secreted at the base of the perianth and protected in the male by the bases of the filaments. The flr. is visited in Low Germany chiefly by short tongued bees, and especially by *Andrena florea* F., which appears to confine itself to this plant (Müller). In Britain we have very few of these insects (in proportion), at any rate in the north and in Wales, and it is noteworthy that the bryony does not occur in Scotland and is rare in Wales. It would probably prove of interest to investigate its mechanism and insect-visitors in various parts of England. Being dioecious, it is dependent upon insects for fertilisation, and it is possible that its distribution is largely determined by that of the insects suited to it (cf. *Aconitum*, *Calystegia*, &c.).
- Bryophyllum** Salisb. Crassulaceae. 4 sp. S. Afr., Madag. *B. calycinum* Salisb. in Trop. of both worlds. In the notches on the leaves of this sp. adventitious buds develop, giving rise to new plants (p. 115). In *B. proliferum* Bowie there are simple and compound leaves on the same plant. Calyx and corolla are both gamophyllous.
- Buchananla** Spreng. Anacardiaceae (1). 20 sp. trop. As.
- Buchnera** Linn. Scrophulariaceae (III. 11). 30 sp. trop.
- Bucklandia** R. Br. Hamamelidaceae. 1 sp. *B. populnea* R. Br. Himal. to Java. The large stipules are folded against one another, enclosing and protecting the young axillary bud or infl. The flrs. are in heads, which stand in groups of 4. They are polygamous or monœcious and are sunk in the axis. The "calyx-tube" becomes visible as a ring after flowering. The wood is valued in the arts.
- Buda** Adans. = *Spergularia* Presl.
- Buddleia** Houst. Loganiaceae. 70 sp. trop. and sub-trop. This genus and its allies are sometimes placed in Scrophulariaceae, but possess stipules (though sometimes reduced to mere interpetiolar lines).
- Buettneria** Loefl. Sterculiaceae. 50 sp. trop.
- Bulbine** Linn. Liliaceae (III). 24 sp. S. Afr.

- Bulbinella** Kunth. Liliaceae (111). 13 sp. S. Afr., N. Z., &c.
- Bulbocodium** Linn. Liliaceae (1). 1 sp. Eur.
- Bulbophyllum** Thou. Orchidaceae (22). 100 sp. trop. and S. temp. Epiphytes with great reduction of leaf surface. The leaves are often mere scales and the assimilation is performed by the tubers. In *B. minutissimum* F. Muell., and other sp., the tubers are hollow with the stomata on the inner surface (cf. the leaf of *Empetrum*). For the flr. see Darwin's *Orchids*, p. 137.
- Bulliarda** DC. = *Tillaea* Michx.
- Bumelia** Sw. Sapotaceae (1). 20 sp. Am.
- Bunchosia** Rich. Malpighiaceae. 30 sp. trop. Am. Like Malpighia.
- Bunias** (Tourn.) Linn. Cruciferae (iv. 19). 5 sp. Medit., As. In some sp. the frt. is provided with hooks.
- Bunium** Linn. = *Carum* L., and *Conopodium* Koch (in part).
- Buphthalmum** Linn. Compositae (iv). 4 sp. Eur., As. minor.
- Bupleurum** (Tourn.) Linn. Umbelliferae (5). 90 sp. Eur., As., Afr., N. Am. 4 Brit. sp. (buplever or hare's ear), of which *B. rotundifolium* L. is most common; it has perfoliate leaves, whence the name throw-wax (thorow-wax) by which it is sometimes known. All sp. have entire leaves, an unusual thing in this order.
- Burbridgea** Hook. f. Zingiberaceae. 1 sp. Borneo (p. 158). The corolla segments are large, the lateral staminodes absent. The small labellum and petaloid sta. stand up in the centre of the flr.
- Burchellia** R. Br. Rubiaceae (8). 1 sp. Cape Col.
- Burlingtonia** Lindl. = *Rodriguezia* Ruiz et Pav.
- Burmanniaceae**. Monocotyledons (Microspermae). A small order of tropical forest plants, chiefly "colourless" saprophytes. *Chief genera*: *Burmannia*, *Thismia*. (See *Nat. Pfl.*, and *Ann. of Bot.* 1895.)
- Bursa** Wigg = *Capsella* Medic.
- Bursera** 'Jacq.' ex Linn. Burseraceae. 45 sp. trop. Am. *B. gummi-fera* L. furnishes the resin known as American Elemi.
- Burseraceae**. Dicotyledons (Archichl. Geraniales). 13 gen. with 300 sp. trop. Shrubs and trees with alt., usually compound, dotted leaves. Balsams and resins occur, in lysigenous or schizogenous passages. Flrs. small, generally unisexual, with disc like Rutaceae, 5- or 4-merous, obdiplostemonous when both whorls of sta. are present. Cpls (5—3). Ovules usually 2 in each. Ovary multiloc. with one style. Drupe or capsule. Seed exalbuminous. Many of the order are useful on account of their resins &c.
- Chief genera*: *Commiphora*, *Boswellia*, *Bursera*, *Canarium*. [Placed by Benth.-Hook. in Geraniales, by Warming in Terebinthinae.]
- Butea** Koen. Leguminosae (111. 10). 4 sp. Ind., China. *B. frondosa* Roxb. is the Dhak or Pulas tree of Bengal, one of the handsomest of trees when in flower. A red juice flows from incisions in the bark; it is known as Bengal Kino and used as an astringent. The flrs. yield an orange-red dye. The tree also yields lac (see *Ficus*).

**Butomaceae.** Monocotyledons (Helobieae). 4 gen. with 5 sp., trop. and temp. Water and marsh herbs with leaves of various types. Infl. usually a cymose umbel. Flr. ♂, regular, 2- or 3-merous, hypogynous. Perianth 6, in two whorls, the outer sepaloid, the inner petaloid (exc. *Butomus*). Sta. 9-∞, with introrse anthers. Cpls. 6-∞, apocarpous, with ∞ anatropous ovules scattered over their inner walls (cf. *Nymphaea*), except on midrib and edges. Follicles; seed ex-albuminous; embryo straight or horse-shoe shaped. The order is united to Alismaceae by Warming, and by Benth.-Hooker.  
*Chief genera:* *Butomus*, *Hydrocleis*.

**Butomus** Linn. Butomaceae. 1 sp., *B. umbellatus* L., the flowering rush, in temp. As., Eur. (incl. Brit.). The infl. consists of a terminal flr. surrounded by 3 bostryx-cymes.

**Butyrospermum** Kotschy. Sapotaceae (1). 2 sp. Afr. The oily seeds of *B. Parkii* Kotschy when pressed yield the "shea butter" used by the natives.

**Buxaceae.** Dicotyledons (Archichl. Sapindales). 6 gen. with 30 sp. temp. and trop. Evergreen shrubs with exstip. leathery leaves, and no latex. Flrs. in heads or spikes, unisexual, regular, apetalous or naked. Sta. 4-∞.  $\bar{G}$  usually (3), 3-locular, with 3 styles which are persistent on the fruit. Ovules 2-1 in each loc., pendulous, anatropous, with dorsal raphe. Fruit a loculicidal capsule, or drupe. Seed with caruncle or none. Endosperm. The order is united to Euphorbiaceae by Benth.-Hooker, but the dorsal raphe of the ovule places it in coh. Sapindales and it differs also in the dehiscence of the fruit; it is placed in Tricoccae by Eichler (Warming).  
*Chief genera:* *Buxus*, *Pachysandra*.

**Buxus** Linn. Buxaceae. 19 sp., 8 in Old World, 11 in W. Ind. *B. sempervirens* L. is the box, common in gardens. The flrs. are in heads, a terminal ♀ flr. surrounded by a number of ♂ flrs. The fruit dehisces explosively, the inner layer of the pericarp separating from the outer and shooting out the seeds by folding into a U-shape (cf. *Viola*). The wood of the box is exceedingly firm and close-grained, and is largely used in turning, wood-engraving &c.

**Byrsonima** Rich. Malpighiaceae. 90 sp. Cent. and S. Am., W. Ind. Fruit a drupe, edible. The bark of some sp. is used in tanning.

**Bystropogon** L'Hérit. Labiatae (VI. 11). 14 sp. Andes, Canary Is.

**Cabomba** Aubl. Nymphaeaceae (11). 4 sp. trop. and sub-trop. Am. Water plants with peltate floating leaves and much-divided submerged leaves (see p. 173 and cf. *Ranunculus*, *Trapa*). The flr. is 3-merous (P 3+3, A 3-6,  $\bar{G}$  usually 3) and fully apocarpous (thus forming a link to the other Ranales, with which the gynæceum of most N. does not agree). Fruit a group of closed follicles. Seed without aril, with endo- and peri-sperm. The ovules are sometimes attached to the midrib of the cpl.

**Cabralea** A. Juss. Meliaceae. 25 sp. trop. Am.



**Cacalia** Linn. = *Senecio* Tourn. (usually same spec. names).

**Caccinia** Savi. Boraginaceae (iv. 1). 7 sp. W. and Cent. As.

**Cachrys** Linn. Umbelliferae (6). 8 sp. Medit., W. and Cent. As.

**Cactaceae.** Dicotyledons (Archichl. Opuntiales). 15 gen. with abt. 900 sp. The order is chiefly localised in the dry regions of trop. Am., but it spreads to a considerable distance N. and S. (*Opuntia missouriensis* is found as far as 59° N.). The cacti are able to stand winter frost very well (as the splendid open-air collection at Cambridge testifies) and so are found far up the mountains (to 12000 ft. and even higher). Even in the damp forest regions some sp. appear as epiphytes. The only representative of the order in the Old World is *Rhipsalis*, found in Afr., Mauritius &c., but several sp. of *Opuntia* &c. are now naturalised in S. Afr., Austr., &c. and are becoming as troublesome as the thistles of the Pampas or *Elodea* in Europe.

The C. are xerophytes of the most pronounced type, exhibiting not merely reduction of the transpiring surface, but also storage of water, often in very great quantity. The vegetative organs show great variety of type; the C. afford an interesting case of a family in which the classification is better based upon them than upon the reproductive organs (see below). The root is generally long and well-developed (in cultivation it is liable to decay). The stem is fleshy, of various shapes, rarely bearing green leaves, and usually provided with sharp barbed thorns, which give a most efficient protection against animals. We shall now consider briefly some of the more important types of shoot found in C. (refer to genera for further details). The nearest approach to the ordinary plant-type is found in *Pereskia*, which has large green leaves, somewhat fleshy, in whose axils are groups of thorns mixed with hairs; the space occupied by these is termed the *areole*. About the morphology of the spines there has been much dispute; most authors regard them as representing the leaves of the axillary shoot, whose stem is undeveloped, but there is also good evidence in favour of the view that they are 'emergences' (p. 116). In some genera they are provided with barbs. The next stage is found in *Opuntia*, where the stem has taken over the water-storing and assimilating functions, but still bears leaves; in some sp. these aid the stem functions throughout life, but in most they fall off very early, and the stem is usually flattened to expose more surface to air and light. Then we come to *Leuchtenbergia*, which has an aloe-like habit with the areoles on the tips of the apparent leaves; the flr. arises either in the axil of the 'leaf' or on the areole. Development shows that the apparent leaf is really a compound structure. The bud stands, not exactly in the axil, but on the base of the leaf, and the two grow out together to form a *leaf-cushion* or *mammilla*, at the outer end of which is the growing point and the rest of the leaf itself; the latter is represented by a small scale (often microscopic) and the former gives rise to the thorns &c. on the areole. The same pheno-

menon is seen in *Mammillaria*, *Cereus* sp. &c. In some cases the growing point divides, during the growth of the mammilla, into two, one on the tip, the other in the axil, of the cushion. The latter gives rise to the flr. In *Cereus*, *Echinocactus*, &c. the stem is more or less cylindrical, bearing ribs on which are the areoles at regular intervals; the rib is formed by the 'fusion' of mammillae, *i.e.* by the growth of the tissue under them during their development (*cf.* formation of sympetalous corolla). In *Phyllocactus*, *Epiphyllum*, and sp. of *Rhipsalis* some or all of the shoots exhibit a flattened leafy form with areoles in notches on their edges. This form appears to be derived from the preceding by abortion of some of the ridges, and reversions are often seen (they appear if access of light be prevented). Lastly, other sp. of *Rhipsalis* show perfectly cylindrical stems.

The bulk of the internal tissue consists of parenchyma in which water is stored; the cell-sap is commonly mucilaginous, thus further obstructing evaporation. The cuticle is thick, and the ridges of the stem are usually occupied by mechanical tissue, whilst the stomata are in the furrows. Everything thus goes to check transpiration to the utmost extent; it is very difficult to dry a cactus for the herbarium, and its vitality is very great. Its growth is slow, but sp. of *Cereus* &c. reach a great size. Vegetative reproduction is frequent in the mammillate forms, and occurs to some extent in others. In garden practice, cacti are often multiplied by cuttings, for a piece cut off and stuck into the soil will usually grow. Grafting is also largely resorted to.

The flrs. are usually solitary (*exc.* *Pereskia*), borne upon or near the areoles or in the axils of mammillae, large and brightly coloured,  $\bar{x}$ , regular or zygomorphic. Perianth ( $\infty$ ), showing gradual transition from sepaloid to petaloid leaves, spirally arranged, often up the side of the ovary (*cf.* *Nymphaea*). Sta.  $\infty$ , epipetalous.  $\bar{G}$  ( $4 - \infty$ ), uniloc. with parietal placentae and  $\infty$  anatropous ovules; style simple. Fruit a berry, the flesh derived from the funicles. Endosperm or none.

The fruit of many sp. is edible (*e.g.* *Opuntia*, &c.). Several sp. are commonly used in making hedges. The Cochineal insect is cultivated on sp. of *Nopalea*, *Opuntia*, &c.

*Classification and chief genera* (after K. Schumann):

1. *CEREOIDEAE* (succulents; leaves reduced to scales, often very minute; no barbed thorns):
  1. *Echinocactae* (flr. funnel- or salver-shaped, in or near the areole): *Cereus*, *Phyllocactus*, *Epiphyllum*, *Echinocactus*, *Melocactus*, *Leuchtenbergia*.
  2. *Mammillariaceae* (*do.*, but in axil of mammilla): *Mammillaria*, *Pelecyphora*.
  3. *Rhipsalideae* (flr. rotate): *Rhipsalis*.
- II. *OPUNTIOIDEAE* (succulents with round or flat leaf-like joints; leaves cylindrical, usually falling very early; barbed

thorns present; flr. rotate): *Opuntia*, *Nopalea* (only genera).

- III. *PERESKIOIDEAE* (habit of ordinary plant, with flat leaves and panicles of flrs.; no barbed thorns): *Pereskia* (only genus).

[Placed in Ficoideales by Benth.-Hook.; Cactiflorae by Warming.]

For further details of this interesting order see genera, and refer to p. 182. See also Goebel, *Pflanzenbiol. Sch.* and *Flora*, 1895, Ganong in *Flora* 1894, and *Bot. Gaz.* 1895, Schumann in *Nat. Pfl.* and Vochting in *Prings. Jahrb.* 1894. *Euphorbia* and *Stapelia* should be carefully compared with the Cactaceae.

**Cactiflorae.** The 8th cohort of Choripetalae (Eichler, Warming).

**Cadaba** Forsk. Capparidaceae (III). 14 sp. trop. Afr., As., Austr. The disc is prolonged posteriorly into a long tube, and both androphore and gynophore are present.

**Cadia** Forsk. Leguminosae (III. 1). 4 sp. trop., E. Afr., Madag., Arabia. Flr. almost regular with free sta.

**Caesalpinia** Linn. Leguminosae (II. 7). 40 sp. trop. and sub-trop. Some climb by aid of hooks (=mid-ribs of leaves). The pods of *C. Bonducella* Fleming are sometimes brought to Eur. by the Gulf Stream. Those of *C. coriaria* Willd. (divi-divi pods) are imported from S. Am. and W. Ind. for tanning.

**Calophora** Presl. = *Blumenbachia* Schrad.

**Cajanus** DC. Leguminosae (III. 10). 1 sp. trop. Afr., As., cultivated in warm countries for its seeds, used like peas. It is known as Dhal in India, pigeon-pea in W. Ind.

**Calile** Linn. Cruciferae (II. 8). 4 sp. Eur., Medit., N. Am., W. Ind. *C. maritima* Scop., the sea-rocket, in Brit. It has fleshy leaves (p. 187).

**Caladenia** R. Br. Orchidaceae (4). 30 sp. Austr., N. Z. The labellum in some sp. is irritable (cf. *Pterostylis*, and see Darwin, *Orchids*, p. 90).

**Caladium** Vent. Araceae (VI). 10 sp. trop. S. Am., often cultivated for their large variegated leaves.

**Calamagrostis** Adans. Gramineae (VIII). 130 sp. temp., 3 in Brit.

**Calamintha** (Tourn.) Lam. Labiatae (VI. 11). 40 sp. N. temp., 3 in Brit. (basil, calamint). Flrs. often gynodioecious.

**Calamus** Linn. Palmae (III). 200 sp. trop. As., Afr., Austr. They are mostly leaf-climbers with thin reedy stems. In some sp. there are hooks on the back of the mid-rib, but the more common type of leaf is one in which the pinnae at the outer end of the leaf are represented by stout spines pointing backwards (cf. *Desmoncus*). The leaf shoots almost vertically out of the bud up among the surrounding vegetation, and the hooks take hold. The stem often grows to immense lengths (500—600 ft.); the plants are very troublesome in tropical forests because the hooks catch in clothes &c. The stripped

stems are largely used, under the name of rattan canes, for making chair bottoms, baskets, cables, &c.

**Calandrinia** H. B. et K. Portulacaceae. 80 sp. Chili to Vancouver, and Austr. The flrs. close very quickly in absence of sunlight.

**Calanthe** R. Br. Orchidaceae (15). 40 sp. trop. There are 8 pollinia, which, if removed and re-introduced, strike the sloping sides of the rostellum and diverge into the stigmas.

**Calathea** G. F. W. Mey. Marantaceae. 60 sp. trop. Am., and 2 W. Afr. The staminode  $\beta$  (see order) is present in most sp.

**Calceolaria** Linn. Scrophulariaceae (II. 4). 130 sp. S. Am., Mexico, N. Z. Many forms and hybrids are cultivated.

**Caldesia** Parl. = *Alisma* Linn.

**Calea** Linn. Compositae (v). 65 sp. Am.

**Calendula** Linn. Compositae (IX). 15 sp. Medit. *C. officinalis* L. is commonly cultivated in gardens under the name marigold. An interesting "hen-and-chickens" variety is sometimes seen, in which each principal head is surrounded by a number of others, springing from the axils of the involucre bracts. The disc florets are  $\delta$ , the ray florets  $\eta$ . Three kinds of fruit occur on the head; many biological meanings have been forced into this fact, but in reality nothing is known as to its significance.

**Calliphruria** Herb. Amaryllidaceae (I). 4 sp. S. Am. Sta. with stipular appendages (see order).

**Calla** Linn. Araceae (III). 1 sp., *C. palustris* L., in N. Eur. Flrs.  $\eta$  with perianth, borne once in two years. For *C. aethiopica* L. see Richardia.

**Calliandra** Benth. Leguminosae (I. 1). 100 sp. trop. and sub-trop. Am., As.

**Callicarpa** Linn. Verbenaceae (IV). 30 sp. trop. and sub-trop.

**Callicoma** Andr. Cunoniaceae. 2 sp. E. Austr.

**Calligonum** Linn. Polygonaceae (II. 3). 20 sp. N. Afr., W. As., Steppe plants.

**Callipeplis** Stev. Rubiaceae (II. 21). 3 sp. Medit.

**Calliprora** Lindl. = *Brodiaea* Sm.

**Callirhoe** Nutt. Malvaceae (II). 7 sp. N. Am., often placed in *Malva*.

**Callistachys** Vent. = *Oxylobium* Andr.

**Callistemon** R. Br. Myrtaceae (II. 2). 11 sp. Austr., often cultivated as greenhouse shrubs ('bottle-brushes'). The axis of the infl. grows on beyond the flrs. and continues to produce leaves (cf. *Eucomis*). The sta. form the conspicuous part of the flr., as is often the case in plants of the dry climate of Austr. (cf. *Acacia* &c.).

**Callistephus** Cass. Compositae (III). 1 sp. China, Japan, largely cultivated in many varieties under the name China aster.

**Callitrichaceae**. Dicotyledons (Archichl. Geraniales). Only genus *Callitriche* (g.v.). As usual in such cases of water-plants (see p. 169 and *Ceratophyllaceae*) the systematic position is doubtful. Benth.-

Hooker unite *C.* with Haloragidaceae, but the differences between the two are considerable. They have also been placed near Caryophyllaceae, Verbenaceae, Boraginaceae, &c., but seem on the whole nearest to Euphorbiaceae, where they are placed by Engler and by Eichler and Warming (Tricoccae).

**Callitriche** Linn. Callitrichaceae. 25 sp. (probably only varieties of 1 or 2), cosmop. (exc. S. Afr.). Several forms of water star-wort are common in Brit. The submerged leaves are longer and narrower than the floating, and the more so the deeper they are below the surface. Land forms also occur. Flr. unisexual, naked, commonly with 2 horn-like bracteoles, protogynous; ♂ of 1 sta.; ♀ of (2) cpls., transversely placed, 4-loc. by 'false' septum (cf. Labiatae), with 2 styles. 1 ovule in each loc., pendulous, anatropous with ventral raphe. Schizocarp. Seed with fleshy endosperm. The modes of fertilisation of the flrs. are not very clearly made out.

**Callitris** Vent. Coniferae (Arauc. 2 a; see *C.* for genus characters). 15 sp. Afr., Madag., Austr., New Caled. Leaves and cone-scales in whorls. The cone ripens in 1 or 2 years. *C. quadrivalvis* Vent. (N. Afr.) yields Arar wood and Sandarach resin or pounce.

**Calluna** Salisb. Ericaceae (iv. 9). 1 sp., *C. vulgaris* Salisb., the heather or ling, widely distributed over Eur. and found in Greenland, and from Newfoundland to Massachusetts (the only representative of Ericoideae in Am.). It covers large areas in these regions, together with sp. of *Erica* and *Vaccinium*. It is a low evergreen shrub, with linear closely crowded wiry leaves and racemes of flrs. The calyx is coloured like the corolla and the latter is almost polypetalous. The honey is much more easily accessible than in *Erica* and there is a larger circle of visiting insects, including however many bees (heather honey is the most valuable of all kinds). The stigma projects beyond the mouth of the flr.; insects touch it first and in probing for honey jostle the anthers. The flr. is also wind fertilised; the loose powdery pollen blows about very easily and the stigma is not covered by the corolla.

**Calcechilus** R. Br. Orchidaceae (4). 3 sp. E. Austr.

**Calochortus** Pursh. Liliaceae (v). 30 sp. W. N. Am.

**Calodendron** Thunb. Rutaceae (iv). 1 sp. S. Afr.

**Calonyction** Choisy. = *Ipomaea* Linn.

**Calophaca** Fisch. Leguminosae (iii. 6). 10 sp. S. Russia to Burmah.

**Calophanes** D. Don. Acanthaceae (iv. A). 40 sp. trop.

**Calophyllum** Linn. Guttiferae (iii). 55 sp. trop., chiefly Old World. *C. Tacamahaca* Willd. and other sp. yield resins known as Tacamahac. [See *Populus*.]

**Calopogon** R. Br. Orchidaceae (14). 4 sp. U. S.

**Calothamnus** Labill. Myrtaceae (ii. 2). 23 sp. W. Austr. The axis goes on bearing leaves beyond the flrs. (cf. *Callistemon*). Sta. in bundles before the petals, the common axis of the bundle very large.

- Calotropis** R. Br. Asclepiadaceae (II. 2). 3 sp. trop. As., Afr.
- Caltha** (Rupp.) Linn. Ranunculaceae (2). 16 sp. temp. *C. palustris* L., in Brit., is the marsh-marigold or king-cup. Honey is secreted by the cpls., and the flrs. have no 'honey leaves,' the calyx being coloured.
- Calycanthaceae.** Dicotyledons (Archichl. Ranales). 2 gen. with few sp. N. Am. and Japan. Shrubs, usually aromatic, with opp., simple leaves and terminal acyclic flrs. on short shoots. Perianth  $\infty$ , perigynous, spiral, showing gradual transition from sepaloid to petaloid leaves. Sta. 5—30. Cpls.  $\infty$ , in hollowed axis; 2 anatropous ovules in each. Achenes enclosed in axis. Embryo large with spirally wound cotyledons, in slight endosperm. *Genera:* Calycanthus, Chimonanthus. [Placed in Ranales by Benth.-Hooker, in Polycarpicae by Warming.]
- Calycanthus** Linn. Calycanthaceae. 3 sp. N. Am. *C. floridus* L. is the Carolina allspice, a favourite garden shrub.
- Calycera** Cav. Calyceraceae. 10 sp. S. Am.
- Calyceraceae** Dicotyledons (Sympet. Campanulatae). 3 gen. with 23 sp., S. Am. Closely allied to Compositae. Herbs with alt. exstip. leaves. Flrs. in heads with involucre of bracts,  $\varnothing$  or  $\sigma$  ?, epigynous, 4—6-merous. Calyx leafy. Filaments of sta. united, anthers free or slightly coherent at base. Ovary 1-loc.; ovule 1, pendulous, anatropous; stigma capitate. Embryo straight in slight endosperm. *Genera:* Boopis, Calycera, Acicarpha. [Placed in Asterales by Benth.-Hooker, in Dipsacales by Warming.]
- Calyciflorae** (Benth.-Hooker). The 3rd series of Polypetalae (p. 142).
- Calycinae** (Benth.-Hooker). The 4th series of Monocotyledons (p. 145).
- Calypso** Salisb. Orchidaceae (8). 1 sp. cold N. temp.
- Calyptranthes** Sw. Myrtaceae (1). 70 sp. trop. Am.
- Calypetrocalyx** Blume. Palmae (IV. 6). 2 sp. Austr., Moluccas.
- Calystegia** R. Br. Convolvulaceae (I. 4). 7 sp. temp. and sub-trop. 2 in Brit., *C. Soldanella* R. Br. on the coasts, and *C. sepium* R. Br., the large convolvulus of our hedges. The fertilisation of this sp. depends largely on the visits of a particular hawk-moth (*Sphinx convolvuli*) and the distribution areas of the two correspond to some extent (cf. Aconitum). Often united to Convolvulus (*q.v.*).
- Camassia** Lindl. Liliaceae (V). 2 sp. N. Am. (Quamash).
- Camellina** Crantz. Cruciferae (IV. 14). 8 sp. Eur., Medit. (1 Brit.).
- Camellia** Linn. Theaceae. 8 sp. Ind., China, Japan. *C. japonica* L. and others are largely cultivated, and many varieties and double-flowered forms exist. The genus is often united to Thea (*q.v.*). *C. Thea* Link., *C. viridis* Link., and *C. Bohea* Lindl. = *T. sinensis* L.
- Camoensia** Welw. Leguminosae (III. 1). 2 sp. W. trop. Afr.
- Campanales** (Benth.-Hooker). The 3rd cohort of Gamopetalae (p. 143).
- Campanula** (Tourn.) Linn. Campanulaceae (I. 1). Abt. 240 sp. N. temp., chiefly Medit. 8 in Brit. The commonest sp. is *C. rotundifolia* L., the blue-bell of Scotland (in England the hare-bell). The

pollen is shed in the bud, the sta. standing closely round the style and depositing their pollen upon the hairs. As the flr. opens the sta. wither, with the exception of their triangular bases that protect the honey, and the style presents the pollen to insects visiting the flr. After a time the stigmas separate and the flr. is now female, and finally the stigmas curl right back on themselves and so effect self-fertilisation. (See order, and cf. *Phyteuma* and *Jasione*.) The seeds are light and are contained in a capsule, which if erect dehisces at the apex, if pendulous at the base, so that the seeds, as is so often the case (cf. *Papaver*), can only escape when the plant is shaken, e.g. in strong winds. Several sp. are cultivated (*Canterbury bells* &c.).

**Campanulaceae.** Dicotyledons (Sympet. Campanulatae). 59 gen. with abt. 1000 sp., temp. and sub-trop. They are mostly perennial herbs (a few trees and shrubs), with alt., ex-tip. leaves, and usually with latex. The infl. may terminate the primary axis, or one of the second order. It is generally racemose, ending with a terminal flr. in Campanuloideae. In some cases, instead of single flrs. in the axils of the bracts of the raceme, small dichasia occur (cf. Labiatae). Others have the whole infl. cymose (*Canarina*, *Pentaphragma* &c.).

The flr. is usually ♂, regular or zygomorphic, epigynous, generally 5-merous. The odd sepal is posterior in Campanuloideae, but anterior in the other groups. In these, however, a twisting of the axis through 180° takes place before the flr. opens (cf. Orchids), so that the odd sepal is finally posterior.  $K_5$ , open;  $C(5)$  valvate;  $A_5$  epigynous; anthers introrse, sometimes united;  $\overline{G}(5)$ , (3) or (2), multi-loc. with axile placentae bearing  $\infty$  anatropous ovules. Style simple; stigmas as many as cpls. Fruit a capsule, dehiscent in various ways in different genera, or a berry. Seeds with fleshy endosperm.

The natural history of the flr. in this order is of interest, both in itself and as exhibiting transitions to the Composite type. Honey is secreted by a disc at the base of the style and is covered in most cases by the triangular bases of the sta., which fit closely together and only allow of the insertion of a proboscis between them. This, taken together with the size of the flrs., their frequently blue colour and pendulous position, points to their being best adapted to the visits of bees. Observation shows this to be the case, but there are also many other visitors of various insect classes, so that this order cannot be placed in the flower class H (see p. 70) but must be placed in class B. A few exceptions occur however; the bulk of the order has large flrs., conspicuous by themselves, but *Phyteuma* and *Jasione* have small flrs. massed together in heads, and therefore come into class B' along with the Compositae.

The general principle of the floral mechanism is the same throughout the order (so far as is known) and agrees with that of the Compositae. The flr. is very protandrous, and the style (with its stigmas closed up against one another) has the pollen shed upon it by the anthers,

either in the bud or later. Usually there is a bunch of hairs upon the style to hold the pollen. For some time the style acts as pollen-presenter to insects visiting the flr.; after a time the stigmas separate and the female stage sets in, and finally, in many cases the stigmas curl back so far that they touch the pollen still clinging to their own style, and thus effect self-fertilisation, so that seed is sure to be set one way or other. For details see genera, especially *Campanula*, *Phyteuma*, *Jasione*, *Lobelia*, and cf. *Compositae*.

*Classification and chief genera* (after Schönland):

I. *CAMPANULOIDEAE* (flr. actinomorphic, rarely slightly zygomorphic; anthers usually free):

1. *Campanuleae* (cor. valvate; flr. symmetrical): *Campanula*, *Phyteuma*, *Wahlenbergia*, *Platycodon*, *Jasione*.
2. *Pentaphragmae* (cor. valvate; flrs. asymmetric, in cinnini): *Pentaphragma* (only genus).
3. *Sphenocleae* (cor. imbricate): *Sphenoclea* (only genus).

II. *CYPHIOIDEAE* (flr. zygomorphic; sta. sometimes united; anthers free): *Cyphia*, *Nemacladus*.

III. *LOBELIOIDEAE* (flr. zygomorphic, rarely almost actinomorphic; anthers united): *Centropogon*, *Siphocampylus*, *Lobelia*.

**Campanulatae.** The 9th cohort of Dicotyledons (Sympet.) See p. 141.

**Campanulinae** (Warming). The 10th cohort of Sympetalae (p. 147).

**Camphora** (Bauh.) Linn. = *Cinnamomum* Tourn.

**Campsidium** Seem. = *Tecoma* Juss.

**Camptosema** Hook. et Arn. Leguminosae (III. 10). 12 sp. S. Am.

**Campylobotrys** Lem. = *Hoffmannia* Sw.

**Camrynema** Labill. Amaryllidaceae (IV). 2 sp. Austr., Tasm. See order.

**Cananga** Hook. f. et Thoms. Anonaceae (3). 3 sp. trop., E. As. to Austr.

*C. odorata* Hook. f. is cultivated for its flrs. which yield the perfume known as Ylang-ylang or Macassar oil.

**Canarina** Linn. Campanulaceae (I. 1). 3 sp. Canary Is., trop. Afr., Moluccas. Like *Campanula*, but usually 6-merous, and with edible berry fruit.

**Canarium** (Rumph.) Linn. Burseraceae. 80 sp. trop. As., Afr.

"*C. commune* L. is said to furnish the resin known as Manilla Elemi" (see *Bursera*). *C. strictum* Roxb. (Malabar) yields black dammar (see *Agathis*).

**Candollea** Labill. in Ann. Mus. Par. 1805 (= *Stylidium* Sw.; for *C.* of Labill. in Nov. Holl. Pl. 1806, see *Hibbertia*). Candolleaceae. 85 sp. Austr., N. Z., E. As. *C. adnata* F. Muell. is often found in greenhouses. It has an irritable gynostemium. Upon the smallest of the corolla segments is a swollen nectary. In the newly opened flr. the gynostemium stands erect. Then it bends downwards till it lies upon the nectary, and the anthers dehisce; the stigma faces upwards. The tension of the tissues (the phenomenon is a case of



strongly marked nutation) now changes-sides, but the gynostemium is prevented from moving by the sticky nectary, until a considerable strain is set up. In this condition a slight touch, *e.g.* by an insect, suffices to free it and it springs violently over, striking the visitor with the stigma and also throwing over it a shower of pollen. The periodic movements go on for some time and may be compared to those of the leaflets of *Desmodium*.

**Candolleaceae** (*Stylidiaceae*). Dicotyledons (Sympet. Campanulatae). 3 gen. with 100 sp. Austr., N. Z., trop. As., S. Am. Small herbs or undershrubs, more or less xerophytic, without latex. Leaves simple, exstip. Flrs. in racemes or cymes, ♂ or unisexual, usually zygomorphic.  $K$  5 or (5), the odd sepal posterior;  $C$  (5), the anterior petal (*labellum*) often different from the rest. Of the 5 sta. only the 2 posterior lateral ones are developed and these are united with the style to form a gynostemium (cf. Orchids, Asclepiads &c.); anthers extrorse.  $\bar{G}$  (2), usually 2-loc., but occasionally the posterior loc. is aborted. Fruit a capsule. Seed with fleshy endosperm. *Genera*: Phyllachne, Levenhookia, Candollea. [Placed in Campanales by Benth.-Hooker, in Campanulinales by Warming.]

**Canella** P. Br. (*Winterana* L.). 2 sp. W. Ind., trop. Am. *C. alba* Murr. yields Canella bark, used as a tonic and stimulant.

**Canellaceae** (*Winteranaceae*). Dicotyledons (Archichl. Parietales). 4 gen. with 7 sp. "One of the best examples of discontinuous distribution of old families (p. 157). 2 gen. with a few sp. in S. Am. and W. Ind., 1 (monotypic) in Madag. and 1 (also monotypic) in E. Afr." (Warburg). Trees with alt., leathery, entire, exstip., gland-dotted leaves. Flrs. solitary or in racemes or cymes, ♂, regular,  $K$  3, imbricate;  $C$  4—12 free or united;  $A$   $\infty$ , hypogynous, completely united into a tube, with extrorse anthers;  $\bar{G}$  (2—6), 1 loc., with 2- $\infty$  semi-anatropous ovules on each parietal placenta. Berry. Embryo straight or slightly curved in rich endosperm. *Genera*: Canella, Cinnamodendron, Warburgia, Cinnamosma. [Placed in Parietales by Benth.-Hooker, in Cistiflorae by Eichler.]

**Canna** Linn. Cannaceae. Over 40 sp. trop. and sub-trop. Am. Several are in cultivation for their handsome flrs., *e.g.* *C. indica* L. (Indian shot). The habit is like that of Zingiberaceae or Marantaceae, but *C.* can be distinguished even when not in flr. by their possessing neither the ligule of the former nor the pulvinus of the latter. The infl. is terminal, and usually composed of 2-flowered cincinni. The two flrs. are homodromous, but the bracteole is to the right in one and to the left in the other (behind one or other of the two lateral sepals in the diagram). Flr. ♂, asymmetric, epigynous.  $K$  3,  $C$  (3). The androeceum is the most conspicuous part of the flr. There is a leafy sta. bearing half an anther on one edge, and a number of petaloid structures round it, usually 3 but sometimes 1 or 4. One of these is the labellum (not equivalent to that of

Zingiberaceae), and is rolled back on itself outwards. The other two are often termed the wings ( $\alpha$   $\beta$  in diagram). When a fourth staminode ( $\gamma$ , cf. Marantaceae) is present it stands behind the fertile sta. Other sp. have only the labellum. The ovary is inferior, of 3 cpls. with a petaloid style, 3-loc.; ovules in 2 rows in each loc., anatropous. Fruit a capsule, usually warty. Seed with perisperm and straight embryo.

As to the morphological explanation of the androeceum, there are two views. Eichler (*Blütendiag.* I. p. 174) regards the labellum as a lateral sta. of the inner whorl, and the fertile sta. together with all the staminodes as the posterior sta. of the same whorl; the other sta. of the inner, and all the sta. of the outer, whorl are wanting. The older view looks upon  $\beta$ ,  $\gamma$ , as the 2 posterior sta. of the outer whorl, and the labellum,  $\alpha$ , and the fertile sta. as the 3 sta. of the inner whorl. [Cf. this flr. with those of Musaceae, Zingiberaceae and Marantaceae.]



Floral diagram of *Canna indica* (after Eichler). The bracteole is omitted. S=petaloid style; L=labellum;  $\alpha$   $\beta$  = staminodes.

The pollen is shed upon the style in the bud; insects alight on the labellum, touch first the terminal stigma and then the pollen. The rhizome of *C. edulis* Ker-Gawl. is edible, containing large quantities of starch.

**Cannabaceae** (Warming) = § IV of Moraceae (*q.v.*).

**Cannabis** (Tourn.) Linn. Moraceae (IV). 1 sp. Cent. As., *C. sativa* L., the Hemp. Infl. like that of *Humulus*  $\sigma$ , dioecious. The hemp is largely cultivated. A valuable fibre, used for ropes &c., is obtained from the stem in the same way as flax is prepared from *Linum* (*q.v.*). In trop. countries, especially India, the plant is cultivated for its narcotic resin (Churrus). This exudes from the leaves and is collected by men brushing through the plants in leathern dresses to which it adheres. The Asiatics are much addicted to the use of hemp as a narcotic; the dried leaves (Gunjah, Hashish, or Bhang) are smoked with or without tobacco, or pounded with water as a drink, and have an intoxicating stimulant effect; the resin is more powerful in its action. "In small quantities it produces pleasant excitement, which passes into delirium and catalepsy if the quantity be increased." For details see *Treas. of Bot.*

**Cannaceae**. Monocotyledons (Scitamineae). Only genus *Canna* (*q.v.*). Often united to Marantaceae.

**Canscora** Lam. Gentianaceae (I. 2). 14 sp. Indo-mal., trop. Afr., Austr.

**Canthium** Lam. = *Plectronia* Linn.

**Cantua** Juss. Polemoniaceae. 7 sp. Peru, Bolivia.

**Capparidaceae.** Dicotyledons (Archichl. Rhœadales). 35 gen. with 300 sp., trop. and warm temp. Many are xerophytes, with reduced, often with inrolled, leaves (cf. *Empetrum*). Herbs or shrubs, with alt. simple or palmate leaves, often with stipules (these are frequently represented by thorns or glands). Flrs. ♂, regular, usually in racemes, bracteate but without bracteoles. The perianth resembles that of Cruciferae ( $K 2 + 2$ ,  $C 4$  diagonal), but great variety occurs in the androecium. In some sp. of *Cleome* there are 4 sta. in two whorls, but elsewhere there are more. Some sp. of *Cleome* &c. show tetradynamous sta. In others, still further branching of the median sta. occurs and usually the posterior sta. is more branched than the anterior. Staminody of some of the branches is frequent. Cpls. typically (2), transverse as in Cruciferae, with parietal placentae but without a replum. In many sp. of sub-order III the number rises to 10 or 12 by the addition of a second whorl of cpls. and by dédoublement. Ovules  $\infty$ , campylotropous.

A further complication is introduced by the presence of axial effigurations &c. in the flrs. Thus a disc may occur between perianth and sta. (usually thicker at the posterior side), or a gynophore between sta. and ovary, or both may occur. Or the disc may grow up in the centre to form an androphore on which the sta. are borne and above them there may be a gynophore also. From the disc there often grow out structures of various shapes and sizes; these may be scales quite free from one another, or, as in *Cadaba* &c., may be united into a tubular structure. Or the scales may, as in *Steriphoma* &c., alternate with and be joined to the sepals.

The fruit is a siliqua (with replum), nut, berry or drupe. Seed exalbuminous with embryo folded in various ways as in Cruciferae. The floral mechanisms are much in want of study. Few of the order are useful: see *Capparis* &c. For further details see Pax in *Nat. Pfl.* from which the above account is condensed.

*Classification and chief genera* (after Pax):

A. Glandular annuals. Siliqua with replum.

I. *CLEOMOIDEAE*: *Cleome*, *Polanisia*.

B. Mostly shrubs, with hairs or scales, rarely glandular. No replum.

II. *DIPTERYGIOIDEAE* (samara): *Dipterygium* (only genus).

III. *CAPPARIDOIDEAE* (berry): *Capparis*, *Cadaba*, *Maerua*.

IV. *ROYDSIOIDEAE* (drupe): *Roydsia*.

C. Prostrate undershrubs. Calyx tube present. Petals (2). Nut.

V. *EMBLINGIOIDEAE*: *Emblingia* (only genus).

[Placed in *Parietales* by Benth.-Hooker, *Rhœadinae* by Warming.]

**Capparis** (Tourn.) Linn. Capparidaceae (III). 150 sp. trop. and sub-trop. (exc. N. Am.). Many sp. climb by aid of recurved stipular

thorns. The flr.-buds of *C. spinosa* L. (Medit.) are well known as capers (cf. *Eugenia*).

**Capraria** (Tourn.) Linn. Scrophulariaceae (III. 10). 4 sp. trop. and sub-trop. Am.

**Caprificus** Gasp. = *Ficus* Tourn.

**Caprifoliaceae**. Dicotyledons (Sympet. Rubiales). 11 gen. with 230 sp. temp. (chiefly N.) and on trop. Mts. Mostly trees and shrubs with decussate usually exstip. leaves (see *Sambucus*). Flrs.  $\frac{5}{2}$ , regular or zygomorphic, in cymes, usually 5-merous with the odd sepal posterior. Sta. in one whorl, epipetalous.  $\overline{G}$  (2—5), multiloc. with 1— $\infty$  pendulous ovules in each loc. Fruit usually a berry or drupe (capsule in *Diervilla*). Embryo small in fleshy endosperm.

*Classification and genera* (after Fritsch): The C. were separated from Rubiaceae, before the tropical forms of R. were well known, chiefly on the ground of their different habit and their want of stipules. The former distinction only divides the C. from the European R. and the latter is vitiated by the fact that *Sambucus* possesses stipules. It has lately been proposed to split off this genus (*q.v.*) as an independent order, and to unite the remaining C. to Rubiaceae. The genus *Adoxa*, placed in C. by Benth.-Hooker, is now erected into an independent order *Adoxaceae* (*q.v.*).

1. *Sambuceae* (leaf pinnate; anthers extrorse): *Sambucus*.
2. *Viburneae* (leaf simple or lobed; anther introrse; all loc. 1-ovuled): *Viburnum*, *Triosteum*.
3. *Linnaeae* (do., but 2 loc. many-ovuled): *Symphoricarpus*, *Abelia*, *Dipelta*, *Linnaea*.
4. *Lonicereae* (do. but all loc. many-ovuled): *Alseuosmia*, *Lonicera*, *Diervilla*, *Leycesteria*.

[Placed in Rubiales by Benth.-Hooker and Warming.]

**Caprifolium** Tourn. ex Linn. = *Lonicera* Linn.

**Capsella** Medic. Cruciferae (IV. 14). 4 sp. N. temp. *C. Bursa-pastoris* Medic. (shepherd's purse) abounds in Brit. and is established as a weed all over the world. The small flrs. fertilise themselves. In early spring and late autumn the sta. are often more or less aborted. The leaves vary much in shape and degree of division in various situations.

**Capsicum** (Tourn.) Linn. Solanaceae (II. 4). 30 sp. Cent. and S. Am., 1 in Japan. *C. annuum* L. is largely cultivated. Its fruits are the familiar chillies or red peppers; when dried and ground they form Cayenne pepper. Other sp. are used in the same way.

**Caragana** Lam. Leguminosae (III. 6). 20 sp. mid-As., China.

**Caraguata** (Plum.) Lindl. Bromeliaceae (4). 12 sp. Colombia. Epiphytes.

**Caraipa** Aubl. Guttiferae (1). 8 sp. trop. S. Am. They yield valuable timber and balsam of Tamacoari, used in curing the itch. [Ternstroemiaceae Benth.-Hooker.]

**Cardamine** (Tourn.) Linn. (incl. *Dentaria* Linn.). Cruciferae (II. 11). 70 sp., chiefly temp. *C. pratensis* L. (cuckoo-flower) and others in Brit. *C. impatiens* L. has an explosive fruit like that of *Eschscholtzia*. *C. chenopodiifolia* Pers. (S. Am.) possesses two kinds of fruit. Those formed on the upper part of the plant are normal siliquae; at the base, in the axils of the leaves of the rosette cleistogamic flrs. are formed which burrow into the soil and produce fruit there (cf. *Arachis*, *Trifolium*, &c.). In *C. pratensis* there is extensive vegetative reproduction by the formation of adventitious buds on the radical leaves (p. 114) and in *C. (D.) bulbifera* R. Br. by means of axillary bulbils.

**Cardiospermum** Linn. Sapindaceae (I). 11 sp. trop., esp. Am.

**Carduus** (Tourn.) Linn. *Synonymy*: *C. acaulis* Linn., *arvensis* Robs., *ferox* Vill., *heterophyllus* Linn., *lanceolatus* Linn., *montanus* Pers., *palustris* Linn., *pratensis* Huds. = *Cnicus* (same sp. names); *C. Marianus* Linn. = *Silybum* M.; *C. mollis* Linn. = *Jurinea* m.; *C. tuberosus* L. = *Cnicus pratensis*. The genera *Carduus*, *Cnicus* and *Cirsium* are very nearly allied, and scarcely any two floras agree in the sp. assigned to them. See *Index Kewensis*.

Compositae (XI). 80 sp. Eur., N. Afr., As. (thistles). *C. nutans* L. and others in Brit.

**Carex** (Dill.) Linn. Cyperaceae (II). Over 500 sp. N. and S. temp., in marshes, &c. About 60 in Brit. (sedges). Grass-like plants. Pseudo-spikelets 1-flowered, arranged in long spikes, which are sometimes unisexual, sometimes with both ♂ and ♀ flrs. The ♀ flr. has a second glume (see order). The flrs. are protogynous and wind-fertilised. There is considerable vegetative reproduction by offshoots. Many of the Brit. sp. are alpine plants; others, e.g. *C. arenaria* L. grow on sand-dunes and have the habit of *Ammophila* (p. 188).

**Carica** Linn. Caricaceae. 24 sp. trop. and sub-trop. Am. *C. Papaya* L., the Papaw, is largely cultivated for its edible fruit, which, as well as the leaves, &c., contains the proteid-ferment papain. If meat be rubbed with it, it becomes soft and tender through partial digestion of the fibres. The flrs. are borne on old wood (p. 167). For details see Solms in *Bot. Zeit.* 1889.

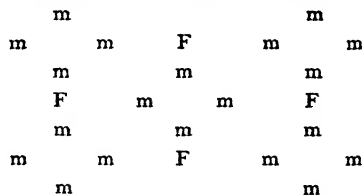
**Caricaceae** (*Papayaceae* Warming). Dicotyledons (Archichl. Parietales). 2 gen. (*Carica*, *Jacaratia*). United to *Passifloraceae* by Benth.-Hooker; placed in *Passiflorinae* by Warming.

**Carissa** Linn. (*Arduina* Mill.). Apocynaceae (I. 1). 20 sp. W. Afr. to Austr. Shrubs with branch thorns.

**Carlina** Linn. Compositae (XI). 17 sp. Eur., and Canary Is. to mid-As. *C. vulgaris* L. (carline-thistle) is common in Brit. *C. acaulis* L. is the weather-thistle of the Alps, &c. The outer bracts of the involucre are prickly, the inner membranous and shining. They spread out like a star in dry air, but in damp weather bend inwards over the fruit-head.

**Carludovica** Ruiz et Pav. Cyclanthaceae. 40 sp. trop. Am. The habit

is that of a small palm (a few are climbers), with short stem and fan leaves, in whose axils arise the infis. Each is a cylindrical spadix, enclosed at first in a number of bracts, which fall off and leave it naked. Its surface is covered with flrs. arranged as in the diagram (after Drude in *Nat. Pfl.*; F = ♀, m = ♂, fr.). The ♂ flr. has a rudimentary perianth, and ∞ sta., united below. The ♀ is sunk in and united with the tissue of the spadix. It has 4 very long staminodes and 4 stigmas corresponding to the 4 placenta in the 1-loc. ovary.



When the spadix opens the ♀ flrs. are ripe and the long staminodes give a tangled appearance to the whole. After a few days the stigmas cease to be receptive and the anthers open. Afterwards the ♂ flrs. drop off and a multiple fruit is formed, composed of berries.

The leaves of *C. palmata* R. & P., gathered young, cut into thin strips and bleached, form the material of which Panama hats are made.

**Carmichaelia** R. Br. Leguminosae (III. 6). 12 sp. N. Z. (1 on Lord Howe's I.). Xerophytes with flattened green stems (phylloclades, see p. 181) and no green leaves (cf. Bossiaea).

**Carpenteria** Torr. Saxifragaceae (III). 1 sp. Calif. Like *Philadelphus*, but ovary superior.

**Carpestum** Linn. Compositae (IV). 8 sp. S. Eur., As.

**Carpinus** Linn. Betulaceae. 12 sp. N. temp. *C. Betulus* L. in Brit. (the hornbeam). The ♀ catkins are terminal on long shoots, the ♂ are themselves short shoots. In the axil of each scale of the latter are 4—10 sta. each split almost to the base. No bracteoles are present, so that it is doubtful how many flrs. of the possible 3 (see order) are represented. In the ♀ there are the 2 lateral flrs. with all 6 bracteoles. On the top of the 2-loc. ovary is a small perianth. The fruit is a 1-seeded nut with a 3-lobed leafy wing on one side, whose centre lobe corresponds to the bract α or β, the lateral lobes to the bracteoles α', β'; these unite and grow large after fertilisation. The hornbeam is very like the beech in habit, but the leaves are not shiny. The timber is not much used.

**Carrichtera** Adans. Cruciferae (II. 9). 1 sp. Medit.

**Carthamus** (Tourn.) Linn. Compositae (XI). 20 sp. Medit., Afr., As. *C. tinctorius* L. is the safflower, largely cultivated in Asia &c.; its flrs. are used in dyeing; powdered and mixed with talc they form rouge.

**Carum** Linn. (incl. *Bunium* Linn., *Petroselinum* Hoffm.). Umbelliferae (5). 60 sp. temp. and sub-trop. *C. Carvi* L. is cultivated for its fruits (caraway seeds). *C. Petroselinum* Benth. and Hook. f. (*P. sativum* Hoffm.) is the common parsley.

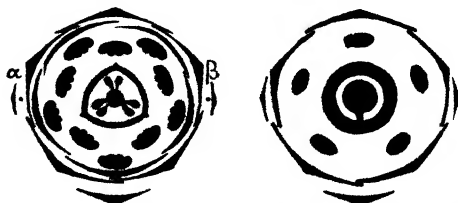
**Carya** Nutt. Juglandaceae. 10 sp. N. Am., the hickory trees, cultivated for their wood, which is very tough and elastic, and for the edible fruit (like walnuts).

**Caryocar** Linn. Caryocaraceae. 10 sp. trop. Am. The wood is very durable and is used in ship-building. The fruit is a large 4-seeded drupe; the seeds are the Souari- or Butter-nuts of commerce.

**Caryocaraceae** (*Rhizophoraceae*). Dicotyledons (Archichl. Parietales). 2 gen. with 13 sp. trop. Am. Trees and shrubs with ternate opp. or alt. leaves with deciduous stipules. Flrs.  $\gamma$  in racemes. K (5—6), C (5—6), A  $\infty$ , united into a ring or in 5 bundles. Ovary free, superior, 4- or 8—20-loc. with as many styles. 1 ovule in each loc. Fruit usually a drupe with oily mesocarp, and woody endocarp which splits into 4 mericarps; sometimes a leathery schizocarp. Little or no endosperm. *Genera*: Anthodiscus, Caryocar. Placed in Ternstroemiaceae by Benth.-Hooker.

**Caryophyllaceae** (incl. *Illecebraceae* or *Paronychiaceae*, and *Scleranthaceae*). Dicotyledons (Archichl. Centrospermae). About 60 gen. with 1300 sp. cosmop. Many in Brit. Most are herbs, a few undershrubs, with opposite simple usually entire leaves, often stipulate; the stem often swollen at the nodes, the branching dichasial. The infl. usually terminates the main axis and is typically a dichasial cyme, but both in the vegetative region and in the infl., of the two branches arising at any node, one (that in the axil of  $\beta$ ) tends to outgrow the other and after two or three branchings the weaker one often does not develop at all, so that a cincinnus arises. The whole infl. is very characteristic, and such an one is often called a caryophyllaceous infl. (p. 51).

The flrs. are  $\gamma$  and regular, but often not isomerous. As a type, the formula of *Lychnis* may serve: K (5), C 5, A 5+5,  $\underline{G}$  (5), with free central placenta, unilocular. Ovules usually  $\infty$ , in double



Floral diagrams of (1) *Silene inflata* and (2) *Paronychia* sp. (after Eichler), showing the ordinary type of flr. in Silenoideae and the most reduced type of Alsinoideae;  $\alpha\beta$  = bracteoles.

rows corresponding to the cpls., rarely few or 1 (*Paronychieae*), usually campylotropous. In most cases the flr. is obdiplostemonous as may be recognised by the cpls. (when 5) being opposite the petals.

Frequently, reduction of the number of parts occurs, *e.g.* we may have G (3) or (2) or rarely (4); A 4 + 4, or 5, 3, 2, or 1, and in other cases the corolla may abort (*Sagina* sp., *Herniaria*, &c.). The ovary, sta., and corolla are sometimes borne on an androphore (*e.g.* *Lychnis*), an elongation of the axis between calyx and corolla. The petals are sometimes provided with a ligule (*e.g.* *Lychnis*), and are often bifid. At the base of the ovary are often seen traces of the septa, which in the upper part do not develop; in some cases the placenta is basal.

Biologically, as well as morphologically, the order separates into two distinct groups, a higher type, the *Silenoideae*, and a lower, the *Alsinoideae*. All secrete honey at the base of the sta., but while in the A. the flr. is wide open, so that short-tongued insects can reach the honey, in the S. a tube is formed by the gamosepalous calyx; in this stand the claws of the petals and the sta., partly filling it up, and rendering the honey inaccessible to any but long-tongued insects, especially bees and Lepidoptera. The latter class, especially in the Alps (see Muller's *Alpenblumen*), are the chief visitors, and many of the S. are adapted to them—by length of tube, red and white colours, night-flowering in many sp., or emission of scent only at night, &c. The flrs. are commonly protandrous. Many A. are gynodioecious (*cf.* *Labiatae*).

The fruit is usually a capsule, containing several or very many seeds. It opens in nearly all cases by splitting from the apex into a certain number of teeth which bend outwards, leaving an opening at the top. The splitting may take place in as many, or in twice as many lines as there are cpls. The seeds cannot escape from the capsule unless it be shaken, *e.g.* by wind or animals, and as they are small and light they thus have a good chance of distribution. The embryo is usually curved round the perisperm (in a few cases it is nearly straight).

*Classification and chief genera (after Pax):*

1. *SILENOIDEAE* (flr. gamosepalous, hypogynous):
  1. *Lychnideae* (calyx with commissural ribs): *Silene*, *Lychnis*.
  2. *Diantheae* (no commissural ribs): *Gypsophila*, *Dianthus*.
- II. *ALSINOIDEAE* (flr. polysepalous; sta. often perigynous).
  - a. Fruit a capsule opening by teeth.
    1. *Alsineae* (styles free to base; leaf exstip.): *Stellaria*, *Cerastium*, *Sagina*, *Arenaria*.
    2. *Sperguleae* (do., but leaf stip.): *Spergula*, *Spergularia*.
    3. *Polycarpeae* (styles joined at base): *Drymaria*, *Polycarpon*.
  - b. Fruit an achene or nut.
    4. *Paronychieae* (flrs. all alike; stipules): *Corrigiola*, *Paronychia*, *Illecebrum*, *Herniaria*.
    5. *Dysphanieae* (do. but leaves exstip. alt.): *Dysphania*.
    6. *Scleranthaeae* (do.; leaves exstip. opp.): *Scleranthus*.





It would appear to be simply another case of variation in symmetry, like *Exacum* or *Saintpaulia*. In many sp. a division of labour takes place among the sta. (cf. *Heeria*); the insect visitors eat the pollen of the short sta. and carry away on their bodies that of the long sta. There is no honey in the flr. The fruit is often chambered up by 'false' septa running across it—outgrowths from the placenta.

Many sp. of *C.* are cultivated for their leaves, which when dried form the drug senna. Alexandrian senna is the product of *C. acutifolia* Delile, Italian of *C. obovata* Collad., Arabian of *C. angustifolia* Vahl. *C. Fistula* L., the purging Cassia or pudding-pipe tree, has its seeds embedded in pulp, which is used as a laxative.

**Cassine** Linn. Celastraceae. 20 sp. S. Afr., Austr., Polynes., trop. Am. See *Elaeodendron*.

**Cassinia** R. Br. Compositae (iv). 18 sp. S. Afr., Austr. N. Z.

**Cassiope** D. Don. Ericaceae (II. 4). 7 sp. boreal. The leaf is very much rolled back (see order and cf. *Empetrum*); in *C. Redowskii* G. Don it is actually hollow.

**Cassytha** Linn. Lauraceae (II). 15 sp. trop., esp. Austr. Parasites with the habit of *Cuscuta*.

**Castalia** Salisb. = *Nymphaea* Linn. (*C. speciosa* Salisb. = *N. alba*.)

**Castanea** Tourn. ex Linn. (excl. *Castanopsis* Spach). Fagaceae. 3 or 4 sp. N. Hemisph. *C. vulgaris* Lam. (*sativa* Mill.) is the Chestnut. The ♂ flrs. are in dichasia of 3—7 flrs., the ♀ in groups of 3, yielding 3 nuts, enclosed in the prickly cupule (cf. others of order and *Aesculus*). The fruit is edible and the tree also yields useful wood and bark (used in tanning). See order for floral diagram.

**Castanopsis** Spach. Fagaceae. 25 sp. trop. India. United to *Castanea* in *Nat. Pfl.*

**Castanospermum** A. Cunn. Leguminosae (III. 1). 1 sp. sub-trop. Austr., *C. australe* A. Cunn., the Australian chestnut, so called because its seeds, when roasted, taste like chestnuts.

**Castilleja** Mutis. Scrophulariaceae (III. 12). 31 sp. N. Am., As., S. Am. (the painted lady or paint-brush). The upper leaves, or sometimes only their outer ends, are brightly coloured, adding to the conspicuousness of the flrs. (cf. *Cornus*, *Poinsettia*, &c.).

**Castilloa** Cervant. Moraceae (II). 2 or 3 sp. Cent. Am., Cuba. The latex of *C. elastica* Cerv. yields caoutchouc (see *Hevea*, &c.).

**Casuarina** Linn. Casuarinaceae. About 25 sp. Austr., Polynes., &c. Trees, often of weeping habit, with long slender green branches, cylindrical and deeply grooved. At the nodes are borne whorls of scale-leaves like those of *Equisetum*. The stomata and green tissue are at the bases of the grooves, whilst the ridges are formed of sclerenchyma, so that the plant is markedly xerophytic. Flrs. unisexual. The ♂ are borne in terminal spikes on short lateral branches. The internodes are short and at every node is a cup (formed of the combined bracts) with several sta. hanging out over the edge. Each represents a ♂ flr.

and has a 2-leaved perianth and 2 bracteoles. The ♀ flrs. are borne in dense spherical heads. Each is naked in the axil of a bract, has 2 bracteoles, and consists of 2 cpls., syncarpous, the posterior loc. empty, the anterior containing 2 or more ovules. The long styles hang out beyond the bracts and wind-fertilisation occurs. Afterwards the whole head becomes woody (bracts as well) enclosing the ripening seeds and protecting them from drought, &c. The seed is winged and is enclosed in the woody bracteoles. For further details see order. The wood of these plants (beef-wood) is valued for its extreme hardness; several sp. are used, known in Austr. as she-oak, forest-oak, &c. The green shoots are used as fodder for cattle.

**Casuarinaceae.** Dicotyledons (Archichl. Fagales?). Only genus *Casuarina* (g.v.). The place to be assigned to this order in the natural system has been much disputed. Its nearest allies seem to be the *Betulaceae*. In 1893 Treub discovered the chalazogamic fertilisation (see art. *Chalazogamiae*) and proposed to remove it from its place near the B. Later discoveries however show that these plants too are chalazogamic, as also *Juglans*, and thus C. may still be kept beside them until further study shows whether the classification of the more primitive Dicotyledons must be entirely altered.

**Casuarineae** (Benth.-Hooker) = preceding. Placed in Unisemales.

**Casuariniflorae** (Warming). The 2nd cohort of Choripetalae (p. 146).

**Catabrosa** Beauv. Gramineae (x). About 7 sp. temp. (1 Brit.).

**Catalpa** Scop. Bignoniaceae (II). 10 sp. Am., E. As. *C. bignonioides* Walt. is often grown in parks. It yields a very durable timber.

**Catananche** Linn. Compositae (XIII). 5 sp. Medit.

**Catasetum** Rich. Orchidaceae (17). 30 sp. trop. Am. Epiphytes.

The flrs. show an extraordinary polymorphism, 3 widely different forms occurring on different (or sometimes on the same) stocks. For a long time these were regarded as separate genera, but it is now known that they are all forms of C. The old genus C. is the ♂ form, *Myanthus* Lindl. the ♀ and *Monachanthus* Lindl. the ♀. The labellum is uppermost in the flr. The pollinia are ejected with great violence when one of the horns of the column is touched. For details see Darwin's *Orchids*, p. 178; Rolfe in *Linn. Soc. Journ.*, 27, 1890, &c.

**Catesbaea** Linn. Rubiaceae (I. 8). 6 sp. W. Ind.

**Catha** Forsk. Celastraceae. 1 sp., *C. edulis* Forsk., trop. Afr. The leaves are used by Arabs in the same way as tea, under the names Khat or Cafta.

**Cathcartia** Hook. f. Papaveraceae (II). 2 sp. Himaal., China.

**Cattleya** Lindl. Orchidaceae (13). 20 sp. trop. Am., largely cultivated for their showy flrs. The labellum encloses the column but is not united to it. From its base a nectary runs down into the ovary, The action of the parts of the flr. is like that of *Epipactis* (Darwin, *Orchids*, p. 143).

**Caucalis** Linn. (incl. *Torilis* Adans). Umbelliferae (8). 18 sp. N. Hemisph., S. Afr. 5 in Brit. (hedge-parsley, &c.).

**Cayaponia** Silva Manso. Cucurbitaceae (111). 70 sp. trop. Am., 1 Afr.

**Ceanothus** Linn. Rhamnaceae. 40 sp. Am., often cultivated as ornamental shrubs.

**Cecropia** Linn. Moraceae (111). 30—40 sp. trop. Am. Trees of rapid growth, with very light wood, used for floats, &c. The infl. is a very complex cyme (see *Bot. Centr.* 57, p. 6). *C. peltata* L. is the trumpet tree, so called from the use made of its hollow stems by the Uaupès Indians (Wallace, *Amaz.* ch. XII). The hollows are inhabited by fierce ants (*Azteca* sp.) which rush out if the tree be shaken, and attack the intruder. Schimper has made a thorough investigation of this *symbiosis* (or living together for mutual benefit) of plant and animal, showing that there is here a true case of myrmecophily as in *Acacia sphaerocephala* (q.v.). These ants protect the *C.* from the formidable leaf-cutter ants. Several adaptations are to be seen in the tree. The internodes are hollow but do not communicate directly with the air. Near the top of each however is a thin place in the wall. A gravid female ant burrows through this and brings up her brood inside the stem. The base of the leaf-stalk is swollen and bears food bodies (cf. *Acacia*) on the lower side, upon which the ants feed. New ones form as the old ones are eaten. Several other sp. show similar features. A very interesting point, that goes to show the true adaptive nature of these phenomena, is that in one sp. the stem is covered with wax which prevents the leaf-cutting ants from climbing up, and in this sp. there are neither food-bodies nor the thin places in the walls of the internodes. *Cecropia* trees that are not inhabited by ants fall an easy prey to the leaf-cutters. Müller once observed a tree stripped by them whilst still inhabited by *Azteca*; investigation showed that it was because the cold had rendered the latter incapable of fighting.

**Cedrela** P. Br. Meliaceae. 20 sp. trop. Many yield valuable timber, e.g. *C. odorata* L., the West Indian Cedar, used in making cigar-boxes, &c., *C. Toona* Roxb., the Cedar-wood of S. India, *C. australis* F. von Muell., the Australian red Cedar, &c.

**Cedronella** Riv. Labiatae (VI. 3). 9 sp. N. Am., Japan, Canaries.

**Cedrus** (Tourn.) Mill. Coniferae (Arauc. 1 b; see *C.* for genus characters). 3 sp., *C. Libani* Barre'. (Cedar of Lebanon), *C. atlantica* Manetti (Atlantic Cedar; Algeria) and *C. Deodara* Loud. (Deodar; Himalaya); all are probably varieties of one sp. whose distribution has become discontinuous (p. 157). They are handsome evergreen trees (often planted for ornament in Brit.) with needle leaves and both long and short shoots; the latter may continue to grow for several years and may even develop into long shoots. Flrs. solitary, in the position of short shoots. The cone ripens in 2—3 years. The wood is very durable and is highly valued for building, &c.

**Ceiba** Medic. = *Eriodendron* DC. (*C. pentandra* Gaertn. = *E. anfractuosum*; *C. Casearia* Medic. = *E. orientale*).

**Celastraceae**. Dicotyledons (Archichl. Sapindales). About 38 gen. with 280 sp., trop. and temp. Trees or shrubs with simple, often leathery, leaves and cymose (rarely racemose) infl. Flr. small, regular, usually 5. K 4—5, free or united, C 4—5. There is usually a well marked disc, on the upper side or edge of which are borne 4—5 sta. Ovary superior, of 2—5 cpls., usually with as many loculi, sometimes partly sunk in the disc. Ovules generally 2 in each loc., usually erect. anatropous or apotropous. Fruit a loculicidal capsule, samara, drupe. berry or indehiscent capsule. Seed usually with brightly coloured aril. Endosperm usually present. *Chief genera*: *Euonymus*, *Celastrus*, *Cassine*. Placed in Celastrales by Benth.-Hooker, in Frangulinae by Warming.

**Celastrales** (Benth.-Hooker). The 9th cohort of Polypetalae (p. 142).

**Celastrineae** (Benth.-Hooker) = Celastraceae.

**Celastrus** Linn. Celastraceae. Over 40 sp. As., Austr., Polynes., N. Am. Climbing shrubs with fruit like *Euonymus*.

**Celmisia** Cass. Compositae (IV). 27 sp. N. Z., &c.

**Celosia** Linn. Amarantaceae (I). 35 sp. trop. and temp. The most interesting is *C. cristata* L., the Cock's-comb, a cultivated (but now hereditary) monstrosity, in which fasciation (p. 122) of the flrs. of the infl. occurs.

**Celsia** Linn. Scrophulariaceae (I. 1). 37 sp. Medit., Afr., As.

**Celtis** Tourn. Ulmaceae. 60 sp. N. temp. and trop. Like *Ulmus*, but with introrse anthers, a drupe fruit, and a curved embryo. The fruit of the nettle-tree (*C. australis* L.) is eaten in Spain, &c. The wood of this sp. is useful for turning, and the tree is also used as a fodder-plant in India.

**Cenchrus** Linn. Gramineae (V). 12 sp. trop. and warm temp. The spikelet is surrounded by an involucre of sterile spikelets, which in some sp. become hard and prickly, surrounding the fruit and acting as a means of distribution by animals (cf. *Tribulus*, &c.). *C. tribuloides* L. is a very troublesome pest in the wool-growing districts of N. Am.

**Cenia** Comm. ex Juss. Compositae (VII). 9 sp. S. Afr. Included in *Cotula* Linn. in *Nat. Pfl.*

**Centaurea** Linn. Compositae (XI). 470 sp. chiefly Medit.; a few in Eur., As., trop. Afr., Am., Austr. Several in Brit. e.g. *C. nigra* L. (knapweed), *C. Scabiosa* L., *C. Cyanus* L. (blue-bottle or corn-flower). In the last two the outer flrs. are neuter with enlarged corolla (cf. *Hydrangea*). *C. Calcitrapa* L. (star-thistle) has long spiny involucre bracts. The flr. of *C.* shows the usual construction but the sta. are sensitive to contact and when touched (e.g. by insects probing for honey) contract, thus forcing out the pollen at the top of tube. In *C. montana* L. and other sp. there is a nectary on each

bract of the involucre. Numbers of ants are thus attracted, which may perhaps frighten away other harmful insects (p. 117). The secretion only goes on whilst the flrs. are open and may also be explained as serving to keep the ants away from the flrs., whose honey they would steal without making any return.

**Centradenia** G. Don. Melastomaceae (1). 4 sp. Mexico, Cent. Am. *C. rosea* Lindl. shows habitual anisophylly (p. 38).

**Centranthus** DC. Valerianaceae. 12 sp. Medit., Eur. *C. ruber* DC. is the red spur-valerian of gardens. The corolla is spurred at the base, and at the end of the spur honey is secreted. The tube of the corolla has a longitudinal partition dividing it into two narrow tubes, one containing the style, the other, lined with downward-pointing hairs, leading to the spur. The flr. is protandrous, and the long narrow tube prevents any but long-tongued insects obtaining the honey.

**Centrolepidaceae.** Monocotyledons (Farinosae). 6 gen. with 32 sp. Austr., N. Z., S. Am., Polynes., S. E. As. Small grass-like herbs with spikes of small flrs., which are ♂ or unisexual, naked or with 1—3 hair-structures round them. Sta. 1—2, Cpls. 1—∞, superior, each with one pendulous orthotropous ovule. *Chief genus:* *Centrolepis*. See *Nat. Pfl.* for details. Placed in Glumaceae by Benth.-Hooker, in Enantioblastae by Warming.

**Centrolepis** Labill. Centrolepidaceae. 20 sp. Austr., E. As.

**Centrolobium** Mart. Leguminosae (III. 8). 3 sp. trop. Am. The pod is winged for winged-carriage and is very spiny.

**Centropogon** Presl. Campanulaceae (III). 90 sp. trop. Am.

**Centrosema** Benth. (*Bradburya* Rafin. of *Nat. Pfl.*) Leguminosae (III. 10). 30 sp. Am.

**Centrospermae.** The 10th cohort of Dicotyledons (Archichl.). See p. 137, and refer to art. Caryophyllaceae for relationships.

**Centunculus** Dill. Primulaceae (III). 3 sp. temp. and sub-trop. (1 in Brit.).

**Cephaelis** Sw. = *Uragoga* Linn. The boundaries of these two genera and the nearly related *Psychotria* Linn. are very ill-defined. The grouping used in this work is that of Schumann in *Nat. Pfl.*

**Cephalanthera** Rich. Orchidaceae (4). 10 sp. N. temp. 3 in Brit. There is no rostellum and the pollen germinates *in situ*, fertilising its own stigma (Darwin, *Orchids*, p. 80). The lateral staminodes (see order) are easily seen upon the column. Darwin regards *C.* as a degraded *Epipactis*.

**Cephalaria** Schrad. Dipsacaceae. 30 sp. Medit.

**Cephalocereus** Pfeiff. = *Cereus* Haw.

**Cephalotaceae.** Dicotyledons (Archichl. Rosales). Only genus *Cephalotus* (g.v.). Placed in Saxifraginae by Warming. Benth.-Hooker include *C.* in Saxifragaceae, from which it differs in having a fully free and apocarpous ovary and basal ovules.

**Cephalotaxus** Sieb. et Zucc. Coniferae (Taxaceae, 4; see C. for genus characters). 4 sp. Japan, China. *C. Fortunei* Hook. is commonly grown in shrubberies. All the shoots are of unlimited growth. Flrs. dioecious, the ♂ in heads in the axils of the leaves of the preceding year, the ♀ stalked, of several pairs of leaves each with a short axillary shoot bearing two ovules. Seeds 1—2, with fleshy aril.

**Cephalotus** Labill. Cephalotaceae. 1 sp., *C. follicularis* Labill., in marshes at King George's Sound, W. Austr. A most interesting plant, having pitchers like those of *Nepenthes* or *Sarracenia*, though it is not nearly related to either. The lower leaves of the rosette form pitchers, the upper are flat and green (cf. this division of labour with that found in *N.* and *S.*). The pitcher has much the same structure as that of *N.* and catches insects in the same way. [See p. 195.] Flr. ♂, apetalous. Perianth 6, valvate. Sta. 6+6. Cpls. 6, free, standing round the apex of the axis, each with 1 (rarely 2) basal erect anatropous ovule with dorsal raphe. Follicle with 1 seed; embryo small in fleshy endosperm.

**Cerastium** Linn. (incl. *Moenchia* Ehrh.). Caryophyllaceae (II. 1). 50 to 100 sp. N. temp. 5 or more in Brit. (mouse-ear chickweed).

**Cerasus** (Tourn.) Linn. = *Prunus* Linn. *C. Avium* Moench., *Laurocerasus* Loisel., *lusitanicus* Loisel., *Padus* Delarb. = *P. Avium*, &c.; *C. vulgaris* Mill. = *P. Cerasus*.

**Ceratolobus** Blume. Palmae (III. 5). 2 sp. Sunda Is. (p. 158).

**Ceratonia** Linn. Leguminosae (II. 5). 1 sp. Medit., *C. Siliqua* L. the carob-tree. The pods (Algaroba or St John's bread) are full of a juicy pulp containing sugar and gum, and are largely used for feeding domestic animals. The seeds are said to have been the original of the carat weights of jewellers.

**Ceratophyllaceae**. Dicotyledons (Archichl. Ranales). Only genus *Ceratophyllum* (q.v.). As is usually the case with highly adapted water-plants (see p. 169) it is very difficult to decide upon a position for the C. in the scheme of classification. The one free cpl. and several perianth leaves seem to place them in Ranales, and they are distinguished from Nymphaeaceae by the orthotropous ovule, whorled leaves, &c. Eichler placed them in Urticinae, Benth.-Hooker as an anomalous order of Monochlamydeae. Warming places them in Polycarpiceae (= Ranales).

**Ceratophylleae** (Benth.-Hooker) = preceding.

- **Ceratophyllum** Linn. Ceratophyllaceae. 3 sp. cosmop., of which *C. demersum* L. and *C. submersum* L. occur in Brit. (hornworts). Water-plants, rootless, with thin stems and whorls of much-divided submerged leaves. The plant decays away behind as it grows in front, so that vegetative multiplication occurs by the setting free of the branches. The old leaves are translucent and horny, whence the common name. Winter buds are not formed, the plant merely sinking to the bottom in autumn and rising again in spring.

Flrs. monoecious, axillary, sessile, with sepaloïd perianth. In the ♂, P about (12), hypogynous; A 12—16 on convex recept., with oval non-cutinised pollen. In the ♀, P (9—10), hypogynous; G 1, the midrib anterior; ovule 1, orthotropous, pendulous. Achene crowned by the persistent style, which in *C. demersum* is hooked. Seed albuminous. The flr. is water-pollinated; the anthers break off and float up through the water (each has a sort of float at top of theca); the pollen is of the same specific gravity as water (cf. *Zostera*) and thus drifts about till it comes in contact with a stigma.

**Ceratopteris** Brong. Polypodiaceae. Only sp. *C. thalictroides* Brong., an aquatic fern (floating or rooted in shallow water) found throughout the Tropics. The succulent fronds are eaten as a vegetable in the Indian Archipelago.

**Ceratostema** Juss. Ericaceae (III. 8). 20 sp. S. Am. Included in *Thibaudia* H. B. et K. in *Nat. Pfl.*

**Ceratostigma** Bunge. Plumbaginaceae. 4. sp. Abyss., Himal., China. The total infl. is racemose, the partials dichasial.

**Ceratozamia** Brongn. Cycadaceae. 6 sp. Mexico.

**Cerbera** Linn. (incl. *Tanghinia* Thou.). Apocynaceae (I. 3). 6 sp. Ind. to New Caled., Madag.

**Cercis** Linn. Leguminosae (II. 4). 5 sp. S. Eur., As., N. Am. *C. Siliquastrum* L., the Judas-tree, flowers in the open in Brit. (Judas is said to have hanged himself on one.) The flrs. appear before the leaves, in little bunches on the older twigs, and have a very papilionaceous look, the two lower petals enclosing the essential organs. Serial buds are formed in the leaf axils.

**Cereus** Mill. (incl. *Cephalocereus* Pfeiff., *Echinocereus* Engelm., *Echinopsis* Zucc., *Pilocereus* Lem.). Cactaceae (I). 220 sp. Am., W. Ind. Most are erect cylindrical forms, rarely branched, with ribs or less often mammillae (see order). A few of the more interesting sp. may be mentioned. *C. giganteus* Engelm. (Texas) is the largest of the cacti; it grows to 70 ft. high and 2 ft. thick with candelabra-like branching (figs. in *Treas. of Bot.* and other books). *C. grandiflorus* Mill. is the night-flowering cactus, whose magnificent and sweetly-scented flrs. open in the evening and wither before morning. Other sp., e.g. *C. triangularis* Mill., behave in the same way. These sp. are mostly trailing forms with adventitious roots upon the stems. *C. (P.) senilis* Salm-Dyck. is the old-man cactus, so called because of the long white hairs with which it is covered. A number of cases of close resemblance may be found between sp. of *C.* and sp. of *Euphorbia*. The fruit of most sp. is edible, and is often made into preserves.

**Cerinth** Linn. Boraginaceae (IV. 4). 7 sp. Eur., Medit.

**Ceropegia** Linn. Asclepiadaceae (II. 4). 80 sp. Afr., As., Austr. Erect or twining herbs or undershrubs, more or less xerophytic. Many have tuberous rootstocks, others are leafless and sometimes



have fleshy *Stapelia*-like stems. The flrs. form a trap like those of *Aristolochia Clematitis*. The corolla tube widens at the base and at the top the teeth spread out, but in some sp. they hold together at the tips, making a sort of umbrella. The tube is lined with downward pointing hairs, and small flies, attracted by the colour and smell, creep into the flr. and cannot escape till the hairs wither, when they emerge with pollinia on their proboscides.

**Ceroxylon** Humb. et Bonpl. *Palmae* (IV. 6). 5 sp. N. Andes. *C. andicolum* H. and B. and other sp. yield a wax (secreted on the stems), used for making candles, &c. One tree yields about 25 lbs.

**Cestichis** Thou. = *Liparis* Rich.

**Cestrum** Linn. (*Habrothamnus* Endl.) *Solanaceae* (IV. 7). 140 sp. trop. and sub-trop. Am. Some are greenhouse plants.

**Ceterach** Willd. = *Asplenium* Linn. *C. officinarum* Willd. (ceterach, Brit.) = *A. Ceterach* Linn.

**Chaenostoma** Benth. *Scrophulariaceae* (II. 7). 62 sp. S. Afr., 1 in Canary Is., 1 in Somaliland.

**Chaerophyllum** Linn. *Umbelliferae* (5). 36 sp. N. temp. *C. temulum* L. is a common weed in Brit.

**Chaetanthera** Ruiz et Pav. *Compositae* (XII). 30 sp. Chili, Peru.

**Chailletia** DC. (*Dichapetalum* Thou.) *Chailletiaceae*. 45 sp. trop. Several sp. have epiphyllous infl. (cf. *Erythrochiton*); this has probably arisen by a development similar to what is seen in the infl. of *Solanaceae*, or in the cushions of *Cactaceae*.

**Chailletiaceae** (*Dichapetalaceae*). *Dicotyledons* (Archichl. *Geraniales*). 3 gen. with 60 sp. trop. Woody plants with entire, stip. leaves. Flrs. in cymose umbels, &c., sometimes epiphyllous, usually regular, ♂ or unisexual, typically 5-merous. Sepals and petals free or united, the latter often bifid. Axis continued into a cup-like disc or scales. Sta. 5, sometimes epipetalous. Cpls. (2—3) each with 2 ovules. Drupe with 1- or 2-locular stone. No endosperm; seed sometimes with caruncle. Chief genus: *Chailletia*. Placed in *Geraniales* by Benth.-Hooker, in *Frangulinae* by Eichler.

**Chalazogamiae**. A division of *Angiospermae*, proposed by Treub as the outcome of his work upon *Casuarina* (*Ann. Buitenzorg*, x. 1891, reviewed in *Nat. Science*, Apr. 1892, and in *Beitr. z. bot. Centralblatt*, 1892, p. 28). The ovules are developed in a somewhat peculiar way, and in each a number of embryo-sacs (macrospores) form, many of which elongate downwards right into the base (chalaza) of the ovule. Usually only one of these is fertile. At its upper end is a single cell which divides vertically into two and one of these may again divide; the latter is regarded as the equivalent of the canal cell in the archegonium of *Pteridophyta*, the former is the ovum, which is peculiar among *Phanerogams* in having a cell-wall. There are also several free nuclei in the embryo-sac, but there are no antipodal cells. The pollen tube passes through the style and the ovarial tissues,

never emerging from them, to the stalk of the ovule, which it thus enters from the chalazal end. It passes upwards inside a sterile macrospore and finally enters the fertile one and fertilises the ovum. The endosperm is formed by the free nuclei in the embryo-sac, in the usual manner.

Both in the development of the macrospores and in the process of fertilisation, the difference between *Casuarina* and all other known Angiosperms (except to some degree the *Loranthaceae*) was so marked, and seemed to place *Casuarina* so much nearer to the *Gymnospermae* (*q.v.*), that Treub proposed to rearrange the Angiosperms thus :

|              |                             |                    |
|--------------|-----------------------------|--------------------|
| Angiospermae | { Porogamae<br>Chalazogamae | { Dicotyledones.   |
|              |                             | { Monocotyledones. |

This proposition has not yet met with general acceptance, and it would be premature to pronounce any verdict at the present time. Observations have been made by Miss Benson (*Trans. Linn. Soc.* II. 3. 1894) and Nawaschin (*Mém. de l'Acad. des sc. de St. Pétersb.*, XLII. 1894, rev. in *Bot. Centr.* 62, p. 324; *Berichte d. bot. Ges.* 1894, p. 163; *Bot. Centr.* 63, 1895, p. 104 and p. 353) on various plants of the allied orders *Betulaceae*, &c. In *Carpinus Betulus* there are several embryo-sacs with tubes (*caeca*) running down into the chalaza, and the pollen tube enters the base of one of these and passes up to the ovum, which is of the ordinary type with synergidae, &c. In *Corylus Avellana* there are several embryo-sacs, but only one sends down a caecum. In *Alnus glutinosa* there is one embryo-sac deep in the nucellus, with no caecum, and *Betula alba* is somewhat similar. Some of the *Fagaceae* also show signs of this peculiar embryo-sac development but are fertilised by way of the micropyle. In *Corylus* and in *Fuglans regia* (according to N.) the embryo-sac at the time of fertilisation contains the 3 antipodal cells and 5 free nuclei, with one of which the male nucleus coalesces, so that a relationship to *Gnetum* (see art. *Gymnospermae*) is perhaps indicated. Lastly, *Ulmus* shows signs of chalazogamic fertilisation, though the pollen tube finally reaches the apex of the nucellus, and *Plantago* also is said to exhibit somewhat similar phenomena.

We may probably accept the view that chalazogamic fertilisation is one of the phenomena attending the passage from gymnospermy to angiospermy, but to base any classification upon it would be premature.

**Chamaecyparis** Spach. *Coniferae* (Arauc. 2 c; see C. for genus characters). 4 sp. N. Am., Japan. *C. nutkaensis* Spach. (*Thuja excelsa* Bong.) is the Sitka cypress or yellow cedar; *C. sphaeroides* Spach (*Thuja sphaeroidalis* Rich.) is the white cedar of N. Am.; *C. (Th.) pisifera* Sieb. et Zucc. and *C. (Th.) obtusa* Sieb. et Zucc. are Japanese. All yield useful timber, especially the first two. The genus is much confused with *Thuja* and *Cupressus* (in nomenclature).

**Chamaedorea** Willd. Palmae (iv. 6). 60 sp. trop. and sub-trop. Am.

Small reedy palms, often forming suckers. Dioecious.

**Chamaelaucium** Desf. Myrtaceae (3). 11 sp. W. Austr.

**Chamaeorchis** Koch. = *Herminium* Willd. [1 sp. Mts. of Eur., *C. (H.) alpina* Rich. See Muller's *Alpenblumen*, p. 73.]

**Chamaerops** Linn. Palmae (1. 2). 2 sp. Medit. *C. humilis* L. is the only sp. of palm found in Eur.

**Chavica** Miq.—*Piper* Linn.

**Cheilanthes** Sw. Polypodiaceae. 55 sp. trop. and temp., esp. on Mts. They are mostly xerophytic and often have the pinnae incurved and the stomata protected by hairs (cf. *Empetrum*).

**Cheiranthus** Linn. Cruciferae (iv. 16). 10 sp. Medit. and N. temp. *C. Cheiri* L., the wall-flower, in Brit.

**Cheirostemon** Humb. et Bonpl. (*Chiranthodendron* Larreat.) 1 sp. Mexico, *C. platanoides* H. et B., the Macpalcxochitlquahuitl. Flrs. large; petals 0; sta. 5, united below and spreading out like fingers above.

**Chelidonium** Linn. Papaveraceae (11). 1 sp. Brit. to E. As., *C. majus* L., the greater celandine.

**Chelone** Linn. Scrophulariaceae (11. 6). 4 sp. N. Am.

**Chenopodiaceae.** Dicotyledons (Archichl. Centrospermae). About 75 gen. with 500 sp. with a peculiar and interesting geographical distribution, determined by the fact that they are nearly all salt-loving (halophilous) plants (p. 187). The 10 chief districts characterised by their presence are (according to Bunge), (1) Austr., (2) the Pampas, (3) the Prairies, (4) and (5) the Medit. coasts, (6) the Karroo (S. Afr.), (7) the Red Sea shores, (8) the S.W. Caspian coast, (9) Centr. As. (Caspian to Himalayas—deserts), (10) the salt steppes of E. As. [For full discussion see Volkens in *Nat. Pfl.*] As Schimper and others have shown, the presence of large quantities of salt in the soil necessitates the reduction of the transpiration, so that the plants which grow in such situations will exhibit the characters of xerophytes, and such is the case with this order. They are mostly herbaceous plants (a few shrubs or small trees), with roots which penetrate deeply into the soil, and with leaves of various types, usually not large, often fleshy, and often covered with hairs. These hairs frequently give a curious and very characteristic mealy feeling to the plant. In some halophytes of this order, the leaves are altogether suppressed, and the plant has curious jointed succulent stems like a miniature cactus (e.g. *Salicornia*). Each "limb" embraces the next succeeding one by a sort of cup at its apex. Even more than in their external form, the C. show xerophytic structure in their internal anatomy, for an account of which, as well as the peculiar mode of growth in thickness, see Volkens in *Nat. Pfl.*

The infl. is often primarily upon the racemose type, but the partial infls. are always cymose, at first often dichasial, but with a tendency to the cincinnus form, by preference of the  $\beta$ -bracteole. The flrs. are

regular, small and inconspicuous, ♀ or unisexual; their mode of fertilisation is not quite clearly understood. Perianth simple, rarely absent, persistent after flowering, of 5, 3, 2 (rarely 1 or 4) leaves, more or less united, imbricate, sepeloid. Sta. as many as or fewer than the perianth segments, opp. to them, hypogynous or on a disc; anthers bent inwards in bud. Ovary superior (semi-inferior in Beta), 1-loc. with 2 (rarely more) stigmas. Ovule 1, basal, campylotropous. Fruit usually a small round nut or achene. Embryo usually surrounding the endosperm, either simply bent or spirally twisted. Few of the order are useful plants; see Beta, Spinacia, Chenopodium, &c.

*Classification and chief genera* (after Volkens). The grouping depends on numerous characters and would occupy too much space; the names of the tribes only are therefore given.

A. *CYCLOLOBEAE*. Embryo ring-shaped, horseshoe-like, con-duplicate or semi-circular, wholly or partially enclosing the endosperm.

1. *Polycnemeae*: Polycnemum.
2. *Beteae*: Beta.
3. *Chenopodieae*: Chenopodium.
4. *Atriplicae*: Spinacia, Atriplex.
5. *Camphorosmeae*: Camphorosma, Kochia.
6. *Corispermaceae*: Corispermum.
7. *Salicornieae*: Salicornia.

B. *SPIROLOBEAE*. Embryo spirally twisted: endosperm wanting or divided into two masses by the embryo.

8. *Sarcobatideae*: Sarcobatus.
9. *Suaedae*: Suaeda.
10. *Salsolae*: Salsola, Haloxylon, Halimocnemis.

Benth.-Hooker and Warming include Basellaceae in C., and place the order in Curvembryae.

**Chenopodium** (Tourn.) Linn. Chenopodiaceae (3). 60 sp. temp. 9 in Brit. (goosefoot, lamb's-quarters, Good King Henry, &c.). The fruit in many sp. is dimorphic; some have horizontal seeds, some vertical (esp. on the terminal twigs of the cymes). *C. anthelminticum* (*ambrosioides*) L. is the worm-seed or Mexican tea, whose essential oil is used as a vermifuge in the U.S. *C. Quinoa* Willd. is an important food plant in S. Am.; its seeds are boiled like rice. It is also recommended as a substitute for spinach.

**Cherleria** Hall. = *Arenaria* Linn.

**Chimaphila** Pursh. Pyrolaceae. 4 sp. N. temp.

**Chimonanthus** Lindl. Calycanthaceae. 1 sp. Japan, *C. fragrans* Lindl., often placed in Calycanthus. The fls. come out early in the year, before the leaves, are very fragrant, and show marked protogyny with movement of the sta.

**Chiococca** P. Br. Rubiaceae (11. 13). 7 sp. trop. Am.

**Chiogenes** Salisb. Ericaceae (11. 5). 1 sp. E. N. Am., 1 Japan (cf. *Epigaea*).

- Chionachne** R. Br. Gramineae (I). 2 sp. Indo-mal. and 1 Austr. (*C. cyathopoda* F. von Muell., a valuable fodder-grass).
- Chionanthus** Royen. Oleaceae (I. 3). 2 sp. N. Am., China. *C. virginicus* Linn. (snowdrop tree) is often grown in shrubberies for its flrs.
- Chione** DC. Rubiaceae (II. 13). 4 sp. W. Ind.
- Chionodoxa** Boiss. Liliaceae (V). 4 sp. Crete and As. Minor. *C. Luciliae* Boiss. (glory of the snow) is a favourite border plant.
- Chirita** Buch.-Ham. Gesneraceae (I). 45 sp. Ceylon, Himal, Indo-mal. United with *Didymocarpus* in *Nat. Pfl.*, under *Roettlera*.
- Chironia** Linn. Gentianaceae (I. 2). 15 sp. Afr.
- Chlaenaceae**. Dicotyledons (Archichl. Parietales). 7 gen. with about 20 sp. Madag. (p. 158), closely allied to Theaceae. See *Nat. Pfl.*
- Chlidanthus** Herb. App. Amaryllidaceae (I). 4 sp. S. Am. Sta. with lateral appendages (see order).
- Chlora** Ren. (*Blackstonia* Huds.). Gentianaceae (I. 2). 3 sp. Medit., Eur. *C. perfoliata* Linn. (yellow-wort) on chalky soil in Brit.
- Chloranthaceae**. Dicotyledons (Archichl. Piperales). 3 gen. with 35 sp., trop. and sub-trop. Herbs, shrubs, or trees, with opp. stip. leaves. Flrs. small, in spikes or cymes, ♂ or unisexual, sometimes with sepaloid perianth. Sta. 1—3, united to one another and to the ovary. Cpl. 1; ovules few, pendulous, orthotropous. Endosperm oily; no perisperm; embryo minute. *Chief genera*: *Chloranthus*, *Hedyosmum*. Placed in *Micrembryae* by Benth.-Hooker, in *Polygoniflorae* by Warming.
- Chloranthus** Sw. Chloranthaceae 10 sp. E. As., E. Ind. Perianth of one leaf, anterior; the centre sta. has a complete anther, the laterals each half an anther (cf. *Fumaria*).
- Chloris** Sw. Gramineae (XI). 40 sp. trop. and warm temp. Several are useful pasture-grasses in Austr., &c.
- Chlorogalum** Kunth. Liliaceae (III). 3 sp. Calif. *C. pomeridianum* Kunth has a large bulb whose inner parts are used as a substitute for soap (cf. *Saponaria*). The outer layers yield a quantity of fibre, used for mattresses, &c.
- Chlorophora** Gaudich. Moraceae (I). 1 sp. W. Afr. and 1 (*C. tinctoria* Gaudich.) trop. Am. The wood of this sp. forms the yellow dye-stuff known as fustic.
- Chlorophytum** Ker-Gawl. Liliaceae (III). 50 sp. trop. In *C. comosum* Baker the infl. is often replaced by a vegetative mode of propagation, long shoots developing in the axils of the bracts; these weigh the stem down to the soil and take root there.
- Chloroxylon** Rumph. Rutaceae (VII). 1 sp. E. Ind., *C. Swietenia* DC., the satin-wood. The timber is largely used in veneering, &c., as it takes a high polish. The tree also yields a resin. [*Meliaceae* B. & H.]
- Choisya** H. B. et K. Rutaceae (I). 1 sp. Mexico.
- Chondrilla** (Tourn.) Linn. Compositae (XIII). 18 sp. N. temp.

**Choripetalae** (Warming) = Archichlamydeae.

**Chorispora** R. Br. Cruciferae (IV. 19). 12 sp. E. Medit., Cent. As.

**Chorizanthe** R. Br. Polygonaceae (I. 1). 34 sp. Am. Some possess an ochrea, usually absent in this group. Flrs. usually single inside the involucre (cf. *Eriogonum*).

**Chorizema** Labill. Leguminosae (III. 2). 15 sp. Austr.

**Chrysalidocarpus** H. Wendl. Palmae (IV. 6). 1 sp. Madag. (*C. lutescens* H. Wendl.). Included in *Hyophorbe* in *Nat. Pfl.*

**Chrysanthemum** (Tourn.) Linn. (incl. *Pyrethrum* Hall.). Compositae (VII). 100 sp. Eur., As., Afr., Am. *C. segetum* L. (corn-marigold) and *C. Leucanthemum* L. (ox-eye or dog daisy) in Brit. The autumn-flowering *C.*, now so fashionable, are cultivated forms of *C. indicum* L. and *C. sinense* Sabine (China, Japan). As in the *Dahlia*, all the florets have become ligulate. *C. Parthenium* Bernh. (Eur.) is the feverfew, a popular remedy against slight fevers; *C. cinerarifolium* Vis. yields Dalmatian insect powder (dried and powdered flrs.), and *C. roseum* Adam. Persian powder.

**Chrysobalanaceae** (Warming) = Rosaceae (suborder VI).

**Chrysobalanus** Linn. Rosaceae (VI. 13). 3 sp. W. Afr., Am. The style is basal, so that the flr. is slightly zygomorphic. *C. Icaco* L. is the Coco plum, whose fruit is eaten in the W. Ind.

**Chrysocoma** Linn. Compositae (III). 8 sp. S. Afr. (For *C. Linosyris* L. see *Aster*.)

**Chrysogonum** Linn. Compositae (V). 1 sp. E. N. Am.

**Chrysophyllum** Linn. Sapotaceae (I). 60 sp. trop., esp. Am. Several serial buds are formed in each leaf-axil in some sp., and the undeveloped ones subsequently give rise to flrs. borne on the old wood (p. 167). *C. Cainito* L. is the star-apple, cultivated in the W. Ind. for its edible fruit.

**Chrysopsis** Ell. Compositae (III). 13 sp. N. Am.

**Chrysosplenium** Tourn. Saxifragaceae (I). 40 sp. N. temp. 2 in Brit. (golden saxifrage). Small herbs with rhizomes bearing both vegetative and flowering shoots. Infl. cymose. The small greenish flrs. are perigynous and apetalous; they are homogamous and visited by various small insects. Cf. *Adoxa*

**Chuquiraga** Juss. Compositae (XII). 40 sp. S. Am. In each leaf-axil are thorns, probably representing the leaves of an undeveloped axillary shoot; above them is a normal branch.

**Chusquea** Kunth. Gramineae (XIII). 35 sp. Am. Like *Bambusa*.

**Cysis** Lindl. Orchidaceae (15). 6 sp. trop. Am. Epiphytes.

**Cibotium** Kaulf. = *Dicksonia* L'Hérit.

**Cicendia** Adans. Gentianaceae (I. 2). 1 sp., *C. pusilla* Griseb., S. W. Eur. (incl. Channel Is.). [For *C. filiformis* Delarb. see *Microcala*.]

**Cicer** (Tourn.) Linn. Leguminosae (III. 9). 14 sp. W. As., Medit. Accessory buds occur in the leaf-axils in some sp. *C. arietinum* L. is the chick-pea or gram, largely cultivated for food in S. Eur. and India.

- Cichorium** (Tourn.) Linn. Compositae (XIII). 8 sp. Medit., Eur. *C. Intybus* L., the chicory, occurs in Brit. The roots, roasted and ground, are mixed with coffee. *C. Endivia* L. is the endive, used as a pot-herb. The leaves are partly blanched by tying them together.
- Cicuta** (Tourn.) Linn. Umbelliferae (5). 6 sp. N. Hemisph. *C. virosa* L. (cow-bane or water-hemlock) in Brit. Highly poisonous.
- Cimicifuga** Linn. Ranunculaceae (2). 9 sp. N. temp. *C. foetida* L. (bugbane, Eur.) is used as a preventive against vermin. The root of *C. racemosa* Nutt. (black snake-root, N. Am.) is used as an emetic in Am. United to Actaea in *Nat. Pfl.*
- Cinchona** Linn. Rubiaceae (1. 4). 40 sp. Andes. Large trees with handsome flrs., heterostyled in some sp. The genus is of great importance as the source of Peruvian bark, one of the most valuable drugs. Its efficacy in fevers &c. depends upon the presence in it of the alkaloids quinine, cinchonidine, &c. The tree used to be cut down to obtain the bark and there was great danger of its extinction (cf. Palauquium) until its cultivation was started on a large scale in the government plantations in India. Several sp. are used, e.g. *C. Calzaya* Wedd. (yellow bark and some of the crown bark), *C. cordifolia* Mutis (Cartagena bark), *C. officinalis* L. [*condaminea* Humb.] (crown or brown Peru bark), *C. succirubra* Pav. (red Peru bark). The yield of alkaloid is increased by wrapping round the stem with moss after removal of part of the bark; the second bark contains more than the first. [See Mueller, *Select Extratrop. Plants.*]
- Cineraria** Linn. Compositae (VIII). 25 sp. S. Afr. Many sp. of Senecio are often included in this genus.
- Cinnamodendron** Endl. Canellaceae. 3 sp. Brazil, W. Ind.
- Cinnamomum** (Tourn.) Linn. Lauraceae (1). 40 sp. S. E. As. The young leaves are often red in colour (p. 167). For floral diagram &c. see order. *C. zeylanicum* Nees. (Ceylon) is the cinnamon tree. The spice is the bark of the young twigs. *C. Cassia* Blume (China, Japan) yields Cassia bark, often used to adulterate cinnamon. Its flower-buds are also used as a spice (cf. Eugenia). *C. Camphora* T. Nees & Eberm. (China, Japan) is the Camphor tree. The wood is heated with water and the camphor volatilises and is collected on straw.
- Cinnamosma** Baill. Canellaceae. 1 sp. Madag.
- Circaea** Tourn. Onagraceae (VIII). 7 sp. N. temp. and arctic. 2 in Brit. (enchanter's nightshade). Flr. dimerous throughout with one whorl of sta. Fertilisation method like that of Veronica. Fruit hooked.
- Cirrhopetalum** Lindl. Orchidaceae (22). 30 sp. trop. As., Austr., Mascarenes.
- Cirsium** (Tourn.) Adans. = Cnicus Tourn.
- Cissampelos** Linn. Menispermaceae. About 70 sp. trop. The ♂ infl. is cymose. The ♀ flr. has a very peculiar zygomorphic structure; there is only one cpl., with one sepal and two petals at one side of it. The petals are often united.

**Cissus** Linn. = *Vitis* Tourn.

**Cistaceae.** Dicotyledons (Archichl. Parietales). 4 gen. with 160 sp.

They grow in dry sunny places, especially on chalky or sandy soil. 3 sp. in S. Am., the rest N. temp. (esp. Medit.). Shrubs and herbs with opp. leaves, often inrolled (cf. Ericaceae), with or without stipules. Glandular hairs are usually present. Flrs. solitary or in cymose infl.,  $\varnothing$ , regular. K 5, the two outer ones usually smaller than the inner (they have sometimes been regarded as bracteoles, but these organs are found lower down); C 5 or 3 or 0, convolute (the petals overlap to right or left according as the 3 inner sepals overlap to left or right respectively); A  $\infty$  on a sub-ovarial disc (sta. developed in descending order);  $\bar{G}$  (5—10 or 3) 1-loc. with parietal (often projecting) placentae. Ovules  $\infty$  or 2 on each, ascending, orthotropous. Styles free. Capsule loculicidal. Endosperm; curved embryo. *Genera*: *Cistus* (ovules  $\infty$ , capsule 5-valved), *Helianthemum* (do., 3-valved), *Hudsonia* (ovules 2, pets. 5), *Lechea* (ovules 2, pets. 3 or 0). Placed in Parietales by Benth.-Hooker, in Cistiflorae by Warming.

**Cistiflorae** (Warming). The 10th cohort of Choripetalae (p. 146).

**Cistineae** (Benth.-Hooker) = Cistaceae.

**Cistus** (Tourn.) Linn. Cistaceae. 30 sp. Medit. *C. creticus* L. and *C. ladaniferus* L. yield the resin ladanum (not to be confused with laudanum), obtained by whipping the leaves with leather thongs. The drug was largely used in the plague and in nervous diseases, but is now little employed. Many sp. are favourite shrubs (gum-cistus).

**Citharexylum** Mill. Verbenaceae (II). 20 sp. trop. Am. The common name fiddle-wood is a corruption of Bois-fidèle.

**Citriobatus** A. Cunn. Pittosporaceae. 2 sp. S. W. Austr.

**Citrullus** Forsk. Cucurbitaceae (III). 4 sp. Afr., Medit., As. *C. vulgaris* Schrad. is the water-melon. *C. Colocynthis* Schrad. the colocynth, whose fruit furnishes the cathartic drug of the same name.

**Citrus** Linn. Rutaceae (x). 30 sp. trop. Old World. Shrubs and trees with usually simple leaves, which show a joint at the meeting place of blade and stalk, indicating their derivation from compound leaves like those of most of the order (cf. Berberis). Axillary thorns occur in some sp. (=metamorphosed leaves of the branch shoot). Flrs. in corymbs,  $\varnothing$ . K and C 4—8. Sta.  $\infty$  in irregular bundles, corresponding to an outer whorl only. Cpls.  $\infty$  (6 or more), syncarpous. A second whorl sometimes appears. Frt. a berry with leathery epicarp. The flesh is made up of large cells which grow out from the inner layer of the pericarp.

Many sp. are cultivated in warm countries, for their fruit. *C. Medica* L., the citron, is the parent sp. of several varieties, e.g. var. *Limonum* the lemon, var. *acida* the lime, var. *Limetta* the sweet lime. *C. Aurantium* L. is the orange, with its varieties *Bergamia*, the Bergamot orange (from which the perfume is obtained), and *Bigaradia* the Seville or bitter orange. *C. decumana* Murr. is the shaddock.



For details see De Candolle's *Orig. of Cult. Plts.* p. 176, or *Treas. of Bot.*

**Cladium** P. Br. Cyperaceae (II). 40 sp. trop. and temp., esp. Austr.

*C. Mariscus* R. Br. (*germanicum* Schrad.), the only Brit. sp., is still abundant in Wicken Fen near Cambridge (the only bit of true fen now left), where it is cut as a crop. Formerly it abounded in the Fens and "was largely used for lighting fires at Cambridge and other places" (Babington).

**Cladrastis** Rafin. Leguminosae (III. 1). 1 sp. Japan &c., and 1 sp. E. N. Am. (cf. *Epigaea*). The wood of the latter (*C. tinctoria* Rafin., the yellow-wood) yields a yellow dye.

**Claoxylon** A. Juss. Euphorbiaceae (A. II. 2). 40 sp. trop. Old World.

**Clarkia** Pursh. Onagraceae (IV). 5 sp. W. N. Am. Favourite border plants. Mechanism of flr. as in *Epilobium*.

**Clausena** Burm. f. Rutaceae (X). 15 sp. trop. Afr., Ind., Austr.

**Clavija** Ruiz et Pav. Myrsinaceae (I). 22 sp. trop. Am. Trees of palm-like habit (p. 165), often with flrs. on the old wood (p. 167).

**Claytonia** Gronov. ex Linn. Portulacaceae. 20 sp. N. temp. and arctic. Two have become naturalised in Brit. There are no stipules. Flrs. in sympodial cymes. Before pollination the flower-stalk is erect; the flr. is protandrous, with outward movement of the sta. after dehiscence. Honey, secreted at the base of each petal, is accessible to short-tongued insects. After pollination, the stalk bends downwards through 180°, to return once more to the erect position when the fruit is ripe. The capsule contains 3 seeds and splits into 3 valves, the seeds lying across the lines of splitting. The inner surfaces of the valves contract as they dry and shoot out the seeds (cf. *Buxus*, *Viola*; fig. in *Ann. of Bot.* 1892).

**Clematis** Dill. ex Linn. (incl. *Atragene* L.). Ranunculaceae (3). 170 sp. cosmop. *C. vitalba* L. (traveller's joy) in Brit. Mostly climbing shrubs with opp., usually compound, leaves. The lower sides of the petioles are sensitive to contact. The petiole bends once round the supporting object, then thickens and becomes lignified (see p. 177). Flrs. in cymes; calyx coloured; no petals or honey secretion. The style often remains persistent upon the fruit and becomes hairy, thus forming a mechanism for wind-distribution.

**Cleome** Linn. Capparidaceae (I). 90 sp. trop. and warm temp. The disc is usually more developed on the posterior side and may bear scales. The gynophore varies much in length. In *C. heptaphylla* L. (?) there are two round shiny outgrowths at the base of the upper petals; these look like honey drops even when not secreting, and may be compared with the "sham-honey" drops of *Lopezia*. The floral mechanism of *C.* requires investigation.

**Clerodendron** Linn. Verbenaceae (IV). 90 sp. trop. and warm temp. *C. Thompsonae* Balf. is a favourite hot-house plant. It has a red calyx and white corolla. The sta. project so as to form the landing

place for insects, and when they are ripe the style is bent down. Afterwards the sta. roll up and the style takes their place. *C. fistulosum* Becc. has hollow internodes inhabited by ants (see *Cecropia* and *Myrmecodia*).

**Clethra** Gronov. Clethraceae. 25 sp. Canaries, N. Am., E. As.

**Clethraceae**. Dicotyledons (Sympet. Ericales). An order composed of the single genus *Clethra*, often considered, *e.g.* by Benth.-Hooker, as an anomalous member of Ericaceae. Shrubs and trees with alternate leaves; flrs. in racemes or panicles, *without bracteoles*, ♂, regular. K 5, C 5, *polypetalous*; A 5+5, hypogynous; *no disc.* Anthers bent *outwards* in bud: pollen in *single* grains. Ovary 3-loc.; style with 3 *stigmas*. Capsular fruit. Seed with endosperm. The characters given in italics are those in which *C.* differ from Ericaceae, and taken together fairly justify the separation.

**Clanthus** Banks et Soland. (*Donia* Don.) Leguminosae (III. 6). 2 sp. Austr., N. Z. Favourite greenhouse plants.

**Clidemia** D. Don. Melastomaceae (I). 100 sp. trop. Am.

**Cliffortia** Linn. Rosaceae (III. 9). 40 sp. S. Afr.

**Clinopodium** Linn. = *Calamintha* Tourn.

**Clintonia** Dougl. = *Downingia* Torr.

**Clitoria** Linn. Leguminosae (III. 10). 30 sp. trop. and sub-trop. The flrs. are inverted and the essential organs therefore touch the insect's back, if it alight on the standard.

**Clivia** Lindl. Amaryllidaceae (I). 3 sp. Cape Col.

**Clusia** Linn. Guttiferae (IV). 80 sp. trop. and sub-trop. Am. They are mostly climbing epiphytes, clasping the host by anastomosing aerial roots, and frequently strangling it altogether (cf. *Ficus Benjamina*, &c.). The fleshy fruit is probably carried from tree to tree by birds.

**Clusiaceae** (Warming) = Guttiferae.

**Cluytia** Linn. Euphorbiaceae (A. II. 5). 28 sp. Afr.

**Clypeola** Linn. Cruciferae (IV. 17). 12 sp. Medit.

**Cneoraceae**. Dicotyledons (Archichl. Geraniales). Only genus *Cneorum*. Placed in Simarubaceae by Benth.-Hooker. Nearly allied to Zygophyllaceae, but separated because they have only one whorl of sta. with no ligules, and have no stipules, but possess oil-glands in the leaves.

**Cneorum** Linn. Cneoraceae. 12 sp. Medit., Canaries.

**Cnestis** Juss. Connaraceae. 9 sp. trop. Afr., As.

**Cnicus** Linn. [incl. *Cirsium* (Tourn.) Adans.]. Compositae (XI). 120 sp. N. Hemisph. Several in Brit. (thistles). The genus is much confused with *Carduus*.

**Cobaea** Cav. Polemoniaceae. 6 sp. trop. Am. *C. scandens* Cav. is a favourite greenhouse climber of very rapid growth. It climbs by aid of tendrils (leaf-structures) which are much branched, the branches ending in sharp hooks. The tendril nutates with great rapidity and

is highly sensitive to contact (as may be seen by rubbing one side and watching it for 5 minutes); the hooks prevent the nutation from dragging away a branch before it has had time to clasp its support (Darwin, *Climbers*, p. 106). The flr. presents interesting features. The closed bud stands erect on an erect stalk, but when it is going to open, the tip of the stalk bends over. The flower is very protandrous with movement of sta. and styles. At first it is greenish with an unpleasant smell, thus presenting the characters of a fly-flower (p. 97), but afterwards it becomes purple with a pleasant honey-like smell (bee-flower). Afterwards the stalk goes through several contortions (cf. *Linaria*, and see Scholtz in Cohn's *Beitrage*, VI).

**Coccinia** Wight et Arn. Cucurbitaceae (IV). 14 sp. trop. As., Afr. The fruit of *C. indica* W. and A. is largely eaten as a vegetable in India.

**Coccocypselum** P. Br. Rubiaceae (I. 7). 8 sp. trop. Am. Heterostyled.

**Coccoloba** Linn. Polygonaceae (III. 5). 125 sp. trop. and sub-trop. *C. uvifera* L., and others, produce edible fruit. For *C. platyclada* F. Muell. see Muehlenbeckia.

**Cocculus** DC. Menispermaceae. About 25 sp. trop. and sub-trop. [The grains known as Cocculus are those of *Anamirta*.]

**Cochlearia** Tourn. (incl. *Ionopsidium* DC., *q.v.*, and *Kerneria* Medic.). Cruciferae (II. 6). 21 sp. Eur., As. Minor. *C. officinalis* Linn. (scurvy-grass) occurs in Brit. in various forms with more or less fleshy leaves, chiefly at the sea-side and on Mts. (p. 189); other sp. also occur, including *C. Armoracia* L. (horse-radish) as an escape. The thick root of this sp. is esteemed as a condiment.

**Cochliostema** Lem. Commelinaceae. 1 sp. Ecuador, *C. odoratissima* Lem., a favourite greenhouse plant. The filaments of the fertile sta. develop both laterally and beyond the anthers into large wings. Anther-loculi spiral. See *Nat. Pfl.*, or Masters in *Linn. Soc. Journ.* XIII.

**Cochlospermum** Kunth. Bixaceae. 13 sp. trop. Mostly xerophytes; some have stout tuberous underground stems; many drop their leaves in the dry season (p. 182).

**Cocos** Linn. Palmae (IV. 7). 30 sp. trop. S. Am., W. Ind. *C. nucifera* L. (cocoa-nut palm) in all trop. countries, and largely cultivated. It grows especially well close to the sea and its fruit is capable of floating long distances uninjured, hence it forms a characteristic feature in the islands of the Pacific (p. 199). It is a tall palm with pinnate leaves and dense monoecious infl. The fruit is one-seeded. The outer layer of the pericarp is fibrous, the inner extremely hard (the shell of the cocoa-nut as sold in shops). At the base are three marks, corresponding to the three loculi of the ovary, two of which have become obliterated. Under one of these marks is the embryo.

The testa is thin and is lined with white endosperm, enclosing a large cavity, partly filled with a milky fluid which serves as a water-supply in germination. The uses of this palm are many; it furnishes many of the necessities of existence to the natives of tropical regions—edible fruit, palm wine (cf. *Borassus*), sugar (cf. *Arenga*), leaves for thatching, palm-cabbages (the young bud cut out of the top of the tree), &c. The fibre (coir) of the pericarp is used in many ways—in making cocoa-nut matting, cables, brushes, &c. Cocoa-nut oil is obtained from the endosperm; by pressure it is separated into a solid part (stearine, used for candles) and a liquid (oleine); the remains of the endosperm (cocoa-nut cake) are used in cattle-feeding. The outer wood of the tree is hard (porcupine wood) and is used in making ornaments, &c.

**Codiaeum** A. Juss. Euphorbiaceae (A. 11. 5). 4 sp. Polynes., Austr.

*C. variegatum* Blume is often cultivated in greenhouses for its curious leaves; some are twisted, some have two blades separated by a length of petiole.

**Codonopsis** Wall. Campanulaceae (1. 1). 13 sp. As.

**Coelebogyne** J. Sm. = *Alchornea* Sw.

**Coelia** Lindl. Orchidaceae (13). 5 sp. trop. Am.

**Coeloglossum** Hartm. = *Habenaria* Willd. [*C. (H.) viride* Hartm.]

**Coelogyne** Lindl. Orchidaceae (7). 50 sp. Indo-mal.

**Coffea** Linn. Rubiaceae (11. 14). 25 sp. trop. Old World. *C. arabica*

L. is the coffee plant, largely cultivated in the tropics. It is a shade-loving plant, and is cultivated in the shade of larger trees. The fruit resembles a cherry in appearance; it is a 2-seeded drupe. The pulp and the endocarp are mechanically removed. The seed ("coffee-bean") has a deep groove on the ventral side. By soaking it in water the endosperm may be softened and the embryo dissected out. The plant is subject to the attacks of many insects and fungi; one of the latter (*Hemileia vastatrix*) was the cause of the ruin of the coffee industry of Ceylon. [See *Haberlandt's Tropenreise*, p. 244.]

**Coix** Linn. Gramineae (1). 4 sp. India, China. The best known is *C. Lachryma* L., Job's tears. It is distinguished by the curious inverted pear-shaped body at the base of each infl. This is the sheath of the bract of the infl., hollowed out and containing the 1-flowered ♀ spikelet; the ♂ spikelets project beyond the mouth. It is cultivated for food in the Himal., and used in medicine in China.

**Cola** Schott et Endl. Sterculiaceae. 14 sp. Afr. The seeds of *C. acuminata* S. et E. are the Kola nuts, largely used by the negroes as a condiment; they contain much caffeine and confer the power of sustaining fatigue (cf. *Erythroxylon*).

**Colchicaceae** (Warming) = Liliaceae (sub-order I).

**Colchicum** Linn. Liliaceae (1). 30 sp. Eur., W. As., N. Afr. *C. autumnale* L., autumn crocus or meadow saffron, in Brit. Below the

soil is a large corm (fig. and description in most text-books). In autumn the flr. appears, projecting out of the soil. The perianth tube is long and the ovary remains below the ground, where it is protected from cold, &c. The flr. is visited by bees, and is protogynous. In the spring the leaves appear and at the same time the capsule is brought above ground by the lengthening of its stalk. The seeds and corms are used in medicine as a remedy in gout.

**Coleonema** Bartl. et Wendl. Rutaceae (IV). 4 sp. S. Afr.

**Coleus** Lour. Labiatae (VII). 60 sp. trop. (exc. Am.). Several hybrid forms, with variegated and coloured leaves, are in cultivation.

**Colletia** Comm. Rhamnaceae. 13 sp. S. Am. The habit is very peculiar; in each axil are two serial buds, of which the upper gives rise to a triangular thorn, while the lower forms flrs. or a branch of unlimited growth.

**Collinsia** Nutt. Scrophulariaceae (II. 6). 17 sp. N. Am., often cultivated as border-plants. The flr. exhibits a close resemblance, both in shape and mechanism, to that of many Leguminosae.

**Collomia** Nutt. Polemoniaceae. 18 sp. N. W. Am. and Chili. The seed coat has an outer covering of cells with mucilaginous walls which swell rapidly when wetted, thus anchoring the seed to a suitable place for germination (cf. *Brassica*, *Linum*, &c.).

**Colocasias** Schott. Araceae (VI). 6 sp. E. Ind. Tuberous herbs or small shrubs. Monoecious. Sta. in synandria. *C. antiquorum* Schott, the Taro or Tania, is largely cultivated in the tropics for its rhizomes, which when boiled lose their poisonous nature and form a valuable food stuff.

**Columellia** Ruiz et Pav. Columelliaceae. 2 sp. Peru, Ecuador. Shrubs with evergreen opp. exstip. leaves. Flrs. in cymes, ♂, nearly regular. K 5, C (5), A 2. Sta. short and thick with irregular broad connective and 1 twisted pollen sac. No disc.  $\bar{G}$  (2), imperfectly 2-loc. Ovules  $\infty$ , anatropous. Style short and thick with broad 2—4-lobed stigma. Capsule, enclosed in calyx. Endosperm.

**Columelliaceae**. Dicotyledons (Sympet. Tubiflorae). Only genus *Columellia* (g.v.). This order represents an old, and now isolated type (p. 129) and has been placed in many positions in the natural system. It is placed in Personales by Benth.-Hooker.

**Columnnea** Linn. Gesneraceae (I) 70 sp. trop. Am. Several are climbers and epiphytes. Anisophylly is frequent (p. 38).

**Columniferae** (Warming). The 12th cohort of Choripetalae (p. 146).

**Colutea** (Tourn.) Linn. Leguminosae (III. 6). 10 sp. S. Eur. to Himal. *C. arborescens* (L. bladder-senna) is frequently cultivated. Its leaves have similar properties to those of senna (*Cassia*) and are used to adulterate the latter. The pods are inflated and burst on being squeezed. They may break off and blow about and thus scatter the seeds, or may catch the wind while still on the plant, and jerk out the seeds as they sway.

**Comarum** Linn. = *Potentilla* Linn. (*C. palustre* L. = *P. Com.*).

**Combretaceae.** Dicotyledons (Archichl. Myrtiflorae). 16 gen. with 240 sp. trop. and sub-trop. Trees and shrubs with alt. or opp. simple leaves and no stipules. Many are climbers, some twining, some with hooks formed of the persistent bases of the petioles. Flrs. usually sessile in racemose infls., ♂, regular. Typical formula:  $K_5, C_5, A_5 + 5$ . Ovary inferior, 1-loc.; ovules 2—5, anatropous, pendulous. Style simple. There is a disc on the summit of the ovary, sometimes with various outgrowths. Fruit dry, 1-seeded, often winged at the angles. Seed exalbuminous; cotyledons usually twisted spirally. See *Nat. Pfl.* for details. *Chief genera*: *Terminalia*, *Combretum*, *Quisqualis*. Placed in Myrtales by Benth.-Hooker, in Myrtiflorae by Warming.

**Combretum** Linn. Combretaceae. 125 sp. trop. and sub-trop., exc. Austr. and Polynes. The fruit of *C. butyrosium* Tal. (trop. Afr.) yields a butter-like substance known in Caffraria as Chiquito, and used by the natives in place of butter.

**Commelina** Linn. Commelinaceae. About 90 sp. trop. *C. coelestis* Willd. is often cultivated. The rhizome of some sp. is edible. The chief interest centres in the flr., where there is division of labour between the sta. (cf. *Heeria*). The flr. stands out horizontally and the sta. and style project beyond the corolla. The upper 3 sta. (in many sp.) are almost sterile, but the lobes are juicy. The two lateral lower sta. and the median one are fully fertile, the latter bending up so that the anther is opposite the centre of the flr. Bees visiting the flr. alight on the lower petals; in so doing they touch the stigma, and are dusted by the two lower lateral anthers; they then collect pollen from the median anther, and often climb higher up and pierce the upper anthers for honey. In some sp. self-fertilisation occurs as the style and sta. crumple up in withering. [See Macleod in *Bot. Jaarb.*, Gent, II. 1890.] *C. benghalensis* L. has subterranean cleistogamic flrs. (see *Nat. Pfl.*).

**Commelinaceae.** Monocotyledons (Farinosae). 25 gen. with 300 sp., mostly trop. and sub-trop. Herbs with jointed stems and alt. sheathing leaves. Infl. usually a cincinnus of the type seen in Boraginaceae. Flr. ♂, usually regular, commonly blue. The typical formula is  $K_3, C_3, A_3 + 3, \bar{G}_3$ , but some of the sta. are commonly absent or staminodial. Calyx and corolla differ in colour and texture. Ovary 3-loc., with a few orthotropous ovules in each loc. Capsule loculicidal or indehiscent. Endosperm fleshy; seed often arillate. *Chief genera*: *Commelina*, *Tradescantia*. Placed in Coronarieae by Benth.-Hooker, in Enantioblastae by Warming.

**Commersonia** Forst. Sterculiaceae. 10 sp. trop. As., Austr.

**Commidendron** Burch. Compositae (III). 3 sp. St Helena (p. 158).

**Commiphora** Jacq. (*Balsamodendron* Kunth). Burseraceae. 50 sp. trop. As., Afr. *C. Myrrha* Engl., and other sp., yield myrrh. The resin exudes from the tree and collects in lumps. It is used in

medicine and as a component of incense, &c. *C. opobalsamum* Engl. is said to yield the resin known as Balm of Gilead. Other sp. yield Bdellium and other resins.

**Compartmentia** Poepp. et Endl. Orchidaceae (28). 4 sp. trop. Am.

**Compositae**. Dicotyledons (Sympet. Campanulatae). The largest order of flowering plants, comprising about 810 genera, with over 11000 sp.—more than 10% of the total number of sp. of Phanerogams. They are distributed over the greater part of the earth. Although so large an order, the C. are well marked in their characters and cannot be confounded with any other order, though they have a superficial likeness to Dipsacaceae and Calyceraceae. [For a genealogical tree of the sympetalous orders with inferior ovary, and their relationships to Umbelliferae, &c., see Hock in *Bot. Centralbl.* 51, 1892, p. 233, and art. *Sambucus*.]

Living as they do in almost every conceivable situation, the C. present great variety in vegetative habit, often within the boundary of a single genus. Of this, *Senecio* (*q.v.*) is a noteworthy example. Water and marsh plants and climbers are rare in the order, and so also are epiphytes. This latter is an interesting point, for the distribution mechanism of these plants is admirably suited to an epiphytic existence, and xerophily is not uncommon in the order (see p. 184). Another feature of interest is that the enormous majority of this most successful order are herbaceous plants; trees and shrubs are comparatively rare. It is worthy of note that the latter form an important feature in the Composite flora of oceanic islands, the reason for which is not very obvious (see Wallace's *Island Life*).

The leaves are usually alt., frequently radical, opp. in Heliantheae, whorled in a few cases, *e.g.* *Zinnia verticillata*. Stipules are rarely present. The root is usually a tap-root, sometimes tuberous as in *Dahlia*, &c., often thickened like that of a carrot, *e.g.* *Taraxacum*, *Cichorium*, &c. For further details of vegetative organs reference must be made to individual genera; *e.g.* *Aster*, *Barnadesia*, *Bellis*, *Bidens*, *Cichorium*, *Dahlia*, *Espeletia*, *Gnaphalium*, *Helianthus*, *Helichrysum*, *Lactuca*, *Mutisia*, *Petasites*, *Senecio*, *Silphium*, *Taraxacum*. &c.

All the tribes with the exception of XII and XIII contain oil-passages in the root, stem, &c. In XIII (*Cichorieae*), laticiferous vessels are present, commonly containing a milky white latex (*e.g.* lettuce, dandelion).

The infl. is of racemose type, the fls. being arranged in heads (*capitula*), or rarely in spikes. These heads are again arranged in many cases into larger infls.—racemes, corymbs, &c., or even into compound heads (*Echinops*, &c.). In this last case, however, the smaller heads contain only one fl. each. The head is surrounded by an involucre of bracts, usually green, which performs for all the fls. of the head the functions that in most plants are performed by the

calices of the individual flrs., viz. protection of the bud and of the young fruit. The flrs. are arranged upon a common receptacle, —the enlarged end of the axis—which may be of various shapes, but is most frequently flat, slightly convex or even spindle-shaped. The shape and the surface-condition of the receptacle are characters of importance in the classification of the order. It may be smooth or hairy, &c.; there may (*Helianthus*, &c.) or may not (*Calendula*, &c.) be, upon it, scaly bracts belonging to the individual flrs. In *Cynareae* these bracts are divided so as to form numerous bristles.

In the simplest case the flrs. of a single head are all alike and  $\gamma$ , but there are many deviations from this type. The flrs. may be all actinomorphic (*tubular*) or all zygomorphic (*ligulate*); see below. Very commonly however, as in the daisy or sunflower, there is a distinction into a *disc* of actinomorphic flrs., and a marginal *ray* of zygomorphic flrs. Or, as in *Centaurea* sp. the outer florets may be actinomorphic but different in size from the central ones. The number of ray-florets varies in different sp., but always according to definite rules (see p. 121).

The *distribution of sexes* among the flrs. of a head is another feature which varies much (for details see Hildebrand, *Geschlechtervertheilung bei den C.*, or Müller, *Fert. of Flrs.*). The most common case is gynomonœcism, the ray-florets being  $\gamma$ , the disc  $\delta$ . This would appear to be a mere correlation due to exigencies of nutrition, and not an "adaptation" (see p. 150); it can hardly be looked upon as advantageous in the direction of cross-fertilisation, in view of the fact that in many sp. the ray-florets are rarely fertilised at all. It seems probable that the extra material in the large corolla is supplied at the expense of the andrœceum. The very large ray-florets of *Centaurea* sp. and others are completely sterile (cf. *Hydrangea*, *Viburnum*, &c.). Other interesting sex-distributions are found in *Tussilago*, *Petasites*, &c. (*q.v.*).

The *flower* is fully epigynous, usually 5-merous. The calyx is absent in *Ambrosia* and its allies, *Siegesbeckia*, &c.; in some cases it appears only as a slightly 5-lobed rim upon the top of the inferior ovary (cf. *Rubiaceae* and *Umbelliferae*); usually it takes the form of hairs or bristles—the *pappus*—and enlarges after fertilisation into a parachute (*Dandelion*) or into hooked bristles (*Bidens*) to aid in distribution (see below). Corolla (5), valvate in bud. It may be actinomorphic (*tubular*) or zygomorphic. Of the latter form there are two varieties, *labiate* (lipped) and *ligulate* (strap-shaped). The latter term, strictly speaking, should be applied to those corollas which are strap-shaped in form



Floral Diagram of Composite flr. with pappus (after Eichler). The small outer lines represent the pappus-bristles.



with 5 teeth at the end representing the petals, but is usually also given to those lipped forms where the lower lip is strap-shaped and ends in 3 teeth. Sta. 5, epipetalous with short filaments, alternating with the petals. Anthers introrse, cohering by their edges (*syngenesious*), forming a tube around the style (cf. *Lobelia*). Ovary inferior, of (2) cpls., with a simple style that forks at the end into two stigmas, an anterior and a posterior (see diagram). The construction of the style and stigma is of importance in the classification of the order. There is often a brush of hairs on the style below the stigmas. Only the inner (upper) surfaces of the stigmas are as a rule receptive to pollen. Ovary 1-loc. with 1 erect, basal, anatropous ovule, which gives an exalbuminous seed with straight embryo, enclosed in the dry indehiscent pericarp. This fruit is usually termed, an achene, but of course is, if one adheres strictly to the usual definitions, a pseudo-nut, as its pericarp is partly of axial nature, and there is more than one cpl. It is often crowned with a pappus (see below).

*Natural History of the Flower.* Being massed together in heads, the individual flrs. may be, and usually are, comparatively very small. By this means this advantage is gained that a single insect visitor may fertilise many flrs. in a short time without having to fly from one to the other, while at the same time there is no loss of conspicuousness, and of course a considerable saving of corolla-material, &c. The various sex-distributions occurring in the order have been mentioned above. Coming now to the mechanism of the individual flr., we find, throughout the order, the same type, the differences between the different genera being in slight and unimportant details. The mechanism itself is simple, but effective. Honey is secreted by a ring-shaped nectary round the base of the style, and is protected from rain and from short-lipped insects by the tube of the corolla. The depth of the tube varies within fairly wide limits, but is never so small as to permit the shortest-lipped insects to obtain the honey. As an order the C. all belong to Muller's floral class B' (see p. 68), but there is considerable variety in the depth of tube &c., and therefore also in the composition of the group of visiting insects to each. Thus the long-tubed purple-flowered *Centaureas* &c. are mainly visited by bees and *Lepidoptera*, while the short-tubed yellow *Leontodons* or white *Achilleas* are visited mainly by flies (see Muller's *Fert. of Flrs.*, or *Ann. of Bot.* June 1895).

At the time when the flr. opens, the style, with its stigmas tightly closed against one another, is comparatively short, reaching up to, or projecting a small distance into, the anther tube. The pollen is shed into this and as the style grows it presses the pollen little by little out at the upper end of the tube where it will come into contact with visiting insects. At last the style itself emerges and the stigmas separate. The flr. is now in its female stage. Finally, in a great

many cases, the stigmas curl so far back that they touch the pollen upon their own style, so that every flr. is certain to set seed, even though it be by self-fertilisation. In a few cases, *e.g.* *Senecio vulgaris*, insect visitors are very rare, and the flr. depends entirely on self-fertilisation. The mechanism is about the simplest and most perfect that exists for attaining the desired ends. A striking contrast is seen in the orchids. Here we have bizarre flowers with most elaborate mechanisms, which yet so rarely effect their purpose that an enormous number of seeds have to be developed in every capsule; in the *C.* on the other hand, we have a simple mechanism, yet so effective that the number of seeds can be reduced to one. An interesting modification of the mechanism is found in *Cynareae* (see *Centaurea*) where the stamens are irritable. See also *Artemisia* (wind-fertilised).

The involucre bracts, or ray-florets, or both, often close up over the central flrs. in cold or wet weather, thus protecting the flrs.

*Natural History of the Fruit.* The ripening fruit-head is generally protected from injury by the involucre bracts, which bend inwards over it, performing the function of a calyx. The calices of the individual flrs. are thus rendered useless in this respect and are, in most *C.*, used for purposes of distribution of the fruit. In the majority of cases, the calyx, after the fertilisation of the flr., grows into the familiar pappus, as seen in dandelions or thistles. This is usually composed of fine hairs, often branched, but in some cases, *e.g.* *Achyraea*, is leafy and membranous. The hairs are hygroscopic and spread out in dry air; this helps in many cases to lever the fruits off the receptacle. In *Bidens* and others the pappus is formed of stout barbed bristles, serving to cause the fruit to adhere to animals. In *Arctium* the involucre bracts become hooked at the tips and cling to animals. In *Xanthium* the receptacle is provided with hooks. In *Siegesbeckia* the bracts are sticky. A few genera, *e.g.* *Helianthus*, *Bellis*, &c., have no special arrangements at all, and the fruits remain upon the common receptacle till jerked off by wind or otherwise. [For other points and for details see genera, and Taliew in *Bot. Centr.* 63, p. 320.]

*General Considerations.* The *C.* are generally regarded as occupying the highest position in the Vegetable Kingdom, and are certainly about the most dominant and aggressive order that it contains. Some of the genera, *e.g.* *Hieracium*, vary so much as almost to defy classification. The success of the order may be put down perhaps to the concurrence of several useful peculiarities, viz.

(1) the massing of the flrs. in heads, surrounded by involucre bracts: from this there results

- (a) greater conspicuousness, especially when ray-florets are developed; (b) a saving of material in the corollas, &c.; (c) the fact that one insect visitor may fertilise many flrs. in a short time without having to fly from one to another:

- (2) the very simple and effective floral mechanism, which ensures  
 (d) protection of honey and pollen; (e) exclusion of the very short-lipped (allotropous) insects, but not too great specialisation for a very narrow circle of visitors; (f) prevention of self- and chance of cross-fertilisation till the last possible moment; (g) certainty of self-fertilisation if the cross fails;  
 (3) the use of the calices of individual flrs. for purposes of seed-distribution, and the very perfect character of the mechanism.

Taking together all these considerations, and comparing them with the features of rival orders, *e.g.* Cruciferae, Gramineae, Rubiaceae, Leguminosae, none of which have so perfect an "outfit," it is not surprising that the Compositae have been so successful.

*Economic uses.* The C. furnish but few useful plants (other than border or greenhouse plants). See *Lactuca*, *Cichorium*, *Cynara*, *Helianthus*, *Carthamus*, *Chrysanthemum*, *Tanacetum*, &c.

*Classification and chief genera* (after Hoffmann). As might be expected from what has been said in the last paragraph, and from what we see in other large and dominant orders such as Cruciferae, Umbelliferae, &c., the classification of the C. and the determination of their genera is a matter of no small difficulty. For the purposes of this work it would be useless to enter into details; we shall therefore give only the primary groupings and their chief genera. [There are several exceptions to the characters given below.]

[*Abbreviations:* cap.=capitulum; tub.=tubular; lig.=ligulate; homog.=flrs. in head all similar as to sex; heterog.=flrs. of different sex in one head, *e.g.* ray ♂ and disc ♀.]

A. *TUBULIFLORAE*. Flrs. of disc not ligulate. No latex.

- I. *Vernoniae* (cap. homog.; flrs. tub., never yellow; anthers arrow-shaped at base, pointed or rarely tailed, with filaments inserted high above the base; stigmas semi-cylindrical, long, pointed, hairy outside); stigmatic papillae all over inner surface: *Vernonia*.
- II. *Eupatorieae* (cap. homog.; flrs. tub., never pure yellow; anthers blunt at base, with filaments inserted at base; stigmas long, but blunt or flattened at tip, with very short hairs; stigmatic papillae in marginal rows): *Ageratum*, *Eupatorium*, *Mikania*.
- III. *Astereae* (cap. heterog. or homog., all or only central flrs. tub.; anthers as in II; stigmas flattened with marginal rows of papillae, and terminal hairy unresponsive portions): *Solidago*, *Bellis*, *Aster*, *Erigeron*, *Baccharis*.
- IV. *Inuleae* (as IV; corolla in tub. flrs. with 4-5-toothed limb; anthers tailed at base; styles various): *Filago*, *Antennaria*, *Gnaphalium*, *Helichrysum*, *Inula*.
- V. *Heliantheae* (style with crown of long hairs above the division; anthers usually rounded at base with basally

inserted filaments; corolla of disc flrs. actinomorphic; pappus not hairy; involucre bracts not membranous at margins; receptacle with scaly bracts): Espeletia, Silphium, Xanthium, Zinnia, Siegesbeckia, Helianthus, Dahlia, Bidens.

VI. *Helenieae* (as V, but receptacle without scaly bracts): Helenium, Tagetes.

VII. *Anthemideae* (as VI, but involucre bracts with membranous tip and edges; pappus O or abortive): Achillea, Anthemis, Chrysanthemum, Matricaria, Tanacetum, Artemisia.

VIII. *Senecioneae* (as V and VI, but pappus hairy): Tussilago, Petasites, Senecio.

IX. *Calenduleae* (cap. with ♀ ray flrs., and usually ♂ disc flrs., with undivided style; anthers pointed at base; receptacle not scaly; no pappus): Calendula.

X. *Arctotideae* (style, below or at point of division, thickened or with circle of hairs; cap. with lig. ray flrs.; anthers acute at base or with longer or shorter point and with filaments inserted above the base): Arctotis.

XI. *Cynareae* (style as in X; cap. homog. or with neuter, rarely ♀, not ligulate, ray flrs.; anthers usually tailed; receptacle usually bristly): Echinops, Carlina, Arctium, Carduus, Cnicus, Cynara, Centaurea.

XII. *Mutisieae* (cap. homog. or heterog.; ray flrs. when present usually 2-lipped; disc flrs. actinomorphic with deeply-divided limb, or 2-lipped): Barnadesia, Mutisia, Stiffia, Gerbera.

B. *LIGULIFLORAE*. All flrs. ligulate. Latex.

XIII. *Cichorieae*: Cichorium, Rhagadiolus, Picris, Crepis, Hieracium, Leontodon, Taraxacum, Lactuca, Tragopogon.

[The C. are placed in Asterales by Benth.-Hooker, in Aggregatae by Warming.]

**Conchophyllum** Blume. = *Dischidia* R. Br.

**Coniferae**. The most important class of the Gymnosperms, though, like the other classes, better represented in former ages than now. They form 2 orders with 34 genera and 350 sp. Like their past history, their present geographical distribution is of great interest (see *Nat. Pfl.* or Drude's *Pflanzengeog.*, from which the following account is condensed). Most C. are evergreen trees of erect habit, and grow in dense forests, forming one of the characteristic features of the vegetation in many parts of the globe (esp. temp. and sub-trop. and mountains). Beginning in the north we find *Juniperus nana* beyond the limit of trees. This limit is largely marked by the C., passed here and there only by the birch. Within it, in the N. temp. zone are broad areas covered with C. (*Larix*, *Abies*, *Pinus*, &c.). Going S.,

their importance decreases and at about 40° N. the C. become practically confined to the mountains. Here we find in Japan and China a region of development characterised by *Cephalotaxus*, *Pseudolarix*, *Cryptomeria*, *Cunninghamia*, *Sciadopitys*, *Chamaecyparis*, *Ginkgo*, &c., mostly endemic genera. In Pacific N. Am. is another region, with *Pseudotsuga Douglasii*, *Sequoia*, *Cupressus Lawsoniana*, *Thuja gigantea*, and *Libocedrus decurrens*, together with endemic sp. of *Abies*, *Tsuga*, *Pinus*, &c. The Himalaya forms another great centre, with many peculiar sp., e.g. *Cedrus Deodara*, *Pinus excelsa* and other sp., *Picea* sp. *Tsuga* sp. &c. The C. of the N. hemisphere are separated from those of the S. by a broad band of tropical forests, &c., only partially broken by groups of C. on the Mts. of the Indo-mal. region and America. In Australia we find *Araucaria*, *Agathis*, *Podocarpus*, &c. In Tasmania, New Zealand and Chili appear *Phyllocladus*, *Fitzroya*, &c. S. America has *Araucaria* sp. *Podocarpus* sp., and others. Few genera and no sp. of C. appear in both N. and S. hemispheres; each sp. is limited to a well-defined area.

The C. are trees or shrubs, usually of monopodial growth, often reaching considerable or even (*Sequoia*) gigantic size. Typically, as may be seen at a glance in a fir or larch plantation, a certain amount of growth is made each year and a number of branches are also formed much at the same level, so that in trees of moderate size the number of 'whorls' of branches is an index of the age. Later on the lower branches usually die off and the branching near the apex becomes less regular. The main stem is radially symmetrical, but the branches, which often grow almost horizontally, have a tendency to dorsiventrality; this is expressed in a two-ranked arrangement of the leaves, twisting of the leaves on their stalks, and so on. Many C. show a difference in their shoots; some (*long shoots*, or *shoots of unlimited growth*) grow continuously onwards, except for the periodical interruption in winter; others (*short shoots*, *shoots of limited growth*, or *spurs*) grow only to a definite size, usually very small, and bear a few leaves. Intermediate conditions occur in *Ginkgo*, *Larix*, *Cedrus*, *Taxodium*, &c. When both kinds occur the foliage leaves are often borne on the short shoots only (see *Pinus* &c. for details). The green leaves are usually entire and are either linear or take the form of closely appressed scales (*Cupressus*, &c.). The only exception is the curious genus *Ginkgo*, the sole surviving relic of an extinct type which in many respects approximated to the Cycads. Mention may also be made of the curious 'double-needles' of *Sciadopitys* and the flat green short shoots of *Phyllocladus* (q.v.).

Anatomically, the C. resemble Dicotyledons in all important points. A very general feature of the class (exc. *Taxus*) is the presence of resin passages in all parts of the plant. The leaves exhibit a somewhat peculiar internal structure (see text-books), which however is admirably suited to xerophytic plants, under which class most

C. come. Living in cold soil, as most of them do, and often with evergreen leaves, it is obviously a necessity to reduce transpiration (see p. 178).

When we turn to the flr., we are met with great difficulties. There are two great rival theories about its morphology, those of Eichler (*Blüthendiag.* or *Nat. Pfl.*) and of Celakovsky (see Warming's *System. Bot.* or *Bot. Jahresb.* 1890, p. 324, also Noll in *Bot. Centr.* 60, p. 131). It would be inconsistent with the plan of this work to enter into a discussion of these; we shall merely state both of them. As the order is usually classified according to the Eichlerian view, we have adopted his theory in the classification and in the details of the genera, without however intending thereby to express any judgment upon its correctness.

The flrs. of C. appear as a rule in the form of *cones*, and are always unisexual, mon- or di-œcious. They are never terminal on the main stem as in Cycads, but are usually borne laterally near to its apex. Sometimes (as in *Pinus* ♂) the cones are massed together in spikes or heads.

Both theories above mentioned agree about the male flr., which is usually a cone or catkin of sta. borne on a central axis. The sta. may be flat, but is commonly more or less peltate, and bears a number of pollen-sacs (not more than 9 as a rule) on its lower surface (see *Pinus*, *Taxus* &c.). Turning now to the female, the cone (to avoid for the present the word flower) consists typically of an axis bearing leaf-like organs. The most familiar case is that of *Pinus* (*q.v.*), where each leaf borne on the axis is a small scale, bearing on its upper surface a very large scale (these latter show on the outside of the cone) on the upper side of which, again, are the two ovules. We may diagrammatically represent it thus, using "cover-scale" to express the lower, "ovuliferous scale" to express the upper, of the two scales. Turning to *Cryptomeria* etc. we find a large scale borne directly on the axis, with a little flap on its upper side near the outer end, and the ovules at the base. The flap is, by both theorists, supposed to represent the ovuliferous scale and so we have what is illustrated by the second diagram. Then in *Cupressineae* etc. we find only one scale, and here the two theorists differ. In the other order, *Taxaceae*, still further difficulties meet us. In *Microcachrys* the ovule is borne upon a leaf of the cone, but in *Phyllocladus* it is axillary and in *Taxus* terminal (see these genera and *Ginkgo*). In most C. there is only one integument, but in *Taxaceae* a second commonly appears, forming an aril, more or less fleshy, round the seed as it ripens.

Now as to the explanation of the facts. Eichler regards the whole

cone as one female flr. with a number of cpls. (the 'cover-scales'). The cpl. may bear the ovule directly, as in the latter cases above mentioned, or may develop upon its upper surface a placenta (ovulif. scale) which bears the ovules. *Cryptomeria* thus represents a stage in this evolution, and the whole may be compared with the division of a leaf into a sterile and fertile part, as in *Ophioglossum*. The rival theory of Celakovsky regards each ovule or pair of ovules with its apurtenances as a female flr. (one cpl. to each ovule) so that the cone is a spike of flrs. A series may be thus drawn: *Ginkgo* (♀ flr. of two cpls. each with one ovule); *Podocarpus* (one cpl., one ovule with two integuments, the whole in the axil of a cover-scale, which is therefore to be regarded as a bract), *Taxus* (flr. reduced to ovule, aril = outer integument; then in the *Araucariaceae* we have spikes of flrs. (cones), the cover-scale being the bract, the ovuliferous scale the combined outer integuments of the ovules of two cpls. (or three, the keel on the middle of the scale in *Pinus* etc. representing the third): a fusion of the bract with the flr. in its axil is supposed to have gone on, and we get next the *Cryptomeria* type, and finally that of *Cupressineae*.

The ovules are orthotropous, except in *Podocarpus*. The processes of development of the ovule, fertilisation, &c., must be studied elsewhere (see arts. *Pinus*, *Gymnospermae*). The cone often becomes hard and woody as the seeds ripen, whilst in other cases it becomes fleshy. The seeds contain an embryo with 2—15 cotyledons, and rich endosperm.

*Natural History.* The C. are entirely wind-fertilised; the pollen is light and powdery, sometimes provided with air-bladders (e.g. *Pinus*), and is produced in enormous quantities. About the time it is shed the scales of the female cones open to receive it and the grains adhere to the sticky fluid at the apex of the ovule. Fertilisation often does not take place for a long time afterwards (see *Pinus* and *Ginkgo*).

The seeds in many genera with woody cones (e.g. *Pinus*) are winged for wind-carriage; in other genera they are animal-distributed, e.g. *Juniperus* (cone fleshy), *Taxus* (fleshy aril), &c.

Further details of the morphology, life history, &c. will be found under the headings *Gymnospermae*, *Pinus* and others of the genera. See also art. *Retinospora*, where the peculiar case of plants retaining the 'seedling' form throughout life is dealt with.

Economically the C. are a most important class, furnishing a large proportion of our timber, as well as resins, tars, turpentine, &c. See genera, especially *Abies*, *Pinus*, *Larix*, *Tsuga*, *Libocedrus*, *Juniperus*, *Taxus*, &c.

*Classification and Key to Genera* (after Eichler and Engler):

N. O. I. ARAUCARIACEAE (Pinoideae). Cones perfect; seeds concealed between scales; testa woody or leathery; no aril.

1. *ABIETINEAE*. Leaves spirally arranged. Ovule usually reversed (micropyle facing axis).
    - 1 a. *Araucariinae* (cpl. simple; 1 ovule, reversed, on middle line).
    - 1 b. *Abietinae* (cpl. + ovulif. scale, the latter large; ovules 2, reversed).
    - 1 c. *Taxodiinae* (cpl. + ovulif. scale, or with swelling on inner side; ovules 2—8, axillary and erect (i.e. with micropyle away from axis), or on surface of cpl. and reversed).
  2. *CUPRESSINEAE*. Leaves (incl. those of cone) opp. or whorled, rarely alt. Ovules erect.
    - 2 a. *Actinostrobinæ* (cone woody when ripe; cpls. valvate).
    - 2 b. *Thujopsidinae* (cone woody when ripe; cpls. imbricate; whorls of all flrs. 2-merous).
    - 2 c. *Cupressinae* (cone woody when ripe; cpl. peltate; whorls of all flrs. 2-merous).
    - 2 d. *Juniperinae* (cone berry- or drupe-like when ripe).
- N. O. II. TAXACEAE (Taxoideae). Cone-formation imperfect; seeds projecting beyond cpls. or even naked. Seed with fleshy aril or drupaceous testa.
3. *PODOCARPEAE*. Seeds more or less reversed. Cpls. always present, 1-seeded.
  4. *TAXEAE*. Seeds erect. Cpls. sometimes wanting.

*Key to Genera.*

*ABIETINEAE:*

- 1 a. *Araucariinae:*
  - Seeds free from cpl. 1. Agathis.
  - „ united to „ 2. Araucaria.
- 1 b. *Abietinae:*
  - A. Long and short shoots both present.
    - a. Long shoots with scale leaves only; the green (needle) leaves on the short shoots. 3. Pinus.
    - b. Needle leaves on both shoots:
      - a. Needles evergreen: fruit 2—3 years in ripening. 4. Cedrus.
      - β. Deciduous: fruit 1 year in ripening.
        1. Cone-scales persistent. 5. Larix.
        - II. „ deciduous. 6. Pseudolarix.
  - B. Shoots of one kind only (long):
    - a. Needles 4-angled. Cone pendulous. Scales persistent. 7. Picea.
    - b. „ flat. Otherwise as a. 8. Tsuga.
    - c. „ „ Cone erect with deciduous scales. 9. Abies.
- 1 c. *Taxodiinae:*
  - A. Long shoots with scale-leaves, and short shoots = double needles. 10. Sciadopitys.



- B. Long shoots only.
- a. Seed reversed.
    - $\alpha$ . Cpl. with narrow scale, transverse, above seed.
      11. Cunninghamia.
    - $\beta$ . Cpl. with ridge-like inner scale. Tasmania.
      12. Arthrotaxis.
    - $\gamma$ . Cpl. shield-shaped, no distinct scale. N. Am.
      13. Sequoia.
  - b. Seed erect.
    - $\alpha$ . Cpl. with toothed scale.
      14. Cryptomeria.
    - $\beta$ . Cpl. shield-shaped, no distinct scale.
      - i. Cone-scales persistent. N. Am. 15. Taxodium.
      - ii. „ „ deciduous. China. 16. Glyptostrobus.
2. *CUPRESSINAE*:
- 2 a. *Actinostrobinæ*:
    - A. Cone with involucre of several whorls of scale-leaves.
      - Whorls 3-merous. 17. Actinostrobus.
    - B. No involucre. 2- 3- or 4-merous. Valvate.
      18. Callitris.
    - C. Transition form to preceding. Cpls. slightly imbricate.
      - 2- 3-merous. 19. Fitzroya.
  - 2 b. *Thujopsidinae*:
    - A. Cpl. with 4—5 seeds. 20. Thujopsis.
    - B. „ „ 2 (1—3) seeds.
      - a. Cpls. 4, the upper pair fertile. 21. Libocedrus.
      - b. „ „ 6—8, both upper pairs fertile. 22. Thuja.
  - 2 c. *Cupressinae*:
    - A. Cpls. many-seeded. 23. Cupressus.
    - B. „ „ 2-seeded. 24. Chamaecyparis.
  - 2 d. *Juniperinae*:
    - Only genus. 25. Juniperus.
3. *PODOCARPEAE*:
- A. Seeds quite reversed, almost or quite concealed between the scales of the (when ripe) fleshy cone. Aril short.
    - a. Cpls. united when ripe. Monœcious. Needle leaves.
      26. Saxegothæa.
    - b. Cpls. free. Diœcious. Leaves scale-like.
      27. Microcachrys.
  - B. Seeds anatropous, projecting beyond cpls. Aril developed as a complete outer integument. 28. Podocarpus.
  - C. Transition to preceding. Seeds inserted on lower half or in angle of cpl., little or not at all reversed.
    29. Dacrydium.
4. *TAXEAE*:
- A. Long and short shoots, the latter phyllorclades.
    30. Phyllocladus.

- B. Long and short shoots, of usual form. Leaf like that of maiden-hair fern. 31. Ginkgo.
- C. Long shoots only.
- a. Cpls. present, but aborting as they ripen, each with 2 ovules. 32. Cephalotaxus.
- b. Cpls. absent; ♀ flower reduced to a naked ovule.
- a. Flr. shoots with 2 ovules. Sta. with 4 pollen sacs. 33. Torreya.
- β. „ „ 1 ovule. Sta. with 6—8 pollen sacs. 34. Taxus.

**Conium** Linn. Umbelliferae (5). 2 sp. Eur., As., Afr. *C. maculatum* L. (hemlock) in Brit. It is very poisonous.

**Connaraceae.** Dicotyledons (Archichl. Rosales). 16 gen. with 160 sp.; they are closely allied to Leguminosae, being chiefly distinguished by the absence of stipules and the (usual) presence of more than two free cpls. They are mostly twining shrubs with alt. exstip. leaves and panicles of regular flrs. K 5, imbricate or valvate; C 5; A 10 sometimes joined below; G 5 or 1 or 4, each with 2 erect orthotropous ovules. Fruit usually one follicle with one seed, albuminous or not, arillate. *Chief genera:* Connarus, Rourea, Cnestis. Placed in Rosales by Benth.-Hooker, in Terebinthinae by Warming.

**Connarus** Linn. Connaraceae. 50 sp. trop. Am., Afr., As.

**Conocephalus** Blume. Moraceae (III). 10 sp. Indo-mal. The leaves of *C. suaveolens* Blume possess water-secreting glands (p. 116).

**Conopodium** Koch. Umbelliferae (5). 12 sp. Eur., As., N. Afr. *C. denudatum* Koch (*Bunium flexuosum* With.) in Brit. (earth nut). The tuberous roots are edible when roasted.

**Conospermum** Sm. Proteaceae (I). 33 sp. Austr. *C. Stoechadis* Endl. has been suggested as a useful plant to introduce into desert regions. "All kinds of pasture animals browse with avidity on the long, tender, and downy flower-stalks and spikes, without touching the foliage" (F. von Mueller).

**Conostylis** R.Br. Amaryllidaceae (III). 32 sp. W. Austr. [Haemodoraceae, Benth.-Hooker.]

**Convallaria** Linn. Liliaceae (VII). 1 sp. N. temp. (incl. Brit.), *C. majalis* L., the lily of the valley, which occurs in woods. The stock develops a few scales and two green leaves annually. The flrs. are homogamous and fertilise themselves in absence of insects.

**Convallariaceae** (Warming) = Liliaceae (suborders VI—XI).

**Convolvulaceae.** Dicotyledons (Sympet. Tubiflorae). About 40 gen. with 1000 sp. trop. and temp. Many are annual herbs, others shrubs or (rarely) trees. Several are thorny xerophytes, many are climbing herbs or lianes, and one (*Cuscuta*) is a climbing parasite. Some have tuberous roots (e.g. *Ipomoea Batatas*), others rhizomes or tuberous stems. Latex is often present. Leaves alt., usually petiolate, rarely with stipules. Accessory buds are often found in the leaf-axils.

Infl. dichasial with tendency to cincinnus or bostryx; bracts and bracteoles present.

Flr. ♂, regular, hypogynous, usually 5-merous. K usually polysepalous, imbricate, the odd sepal posterior; C sympetalous, of various shapes, usually induplicate-valvate, sometimes convolute; sta. 5, alternating with pets., epipetalous, on base of corolla, with usually introrse anthers. Ovary on a honey-secreting disc, of 2 cpls. (rarely 3—5), syncarpous with axile placentae; ovules 2 in each loc. (rarely 4), erect, anatropous or semi-anatropous, the micropyle facing outwards and downwards; one integument. Berry, nut or capsule; seeds albuminous.

The flrs. are usually large and brightly coloured and are visited by insects. Extra-floral nectaries are found in many sp. on the petiole. Few are of economic value except for their handsome flrs. (see Ipomoea).

The C. are closely related to Solanaceae, Boraginaceae and other Tubiflorae. See *Nat. Pfl.* and esp. note by Engler at p. 1 of art. C.

*Classification and Chief Genera* (after Peter):

I. *CONVOLVULOIDEAE* (independent green plants):

1. *Dichondreae* (ovary usually divided, with 2 gynobasic styles; fruit like Labiatae): *Dichondra*, *Falkia* (only genera).
2. *Dicranostyleae* (ovary not divided; styles 2, or 1 bifid; flr. 5-merous): *Dicranostyles*, *Evolvulus*.
3. *Hildebrandtieae* (as 2, but 4-merous; 2 outer sepals large in fruit, united to peduncle): *Hildebrandtia* (only genus).
4. *Convolvuleae* (as 2, but style undivided): *Porana*, *Ipomoea*, *Convolvulus*.
5. *Erycibeae* (style very short; corolla lobes deeply bifid; berry; one seed): *Erycibe* (only genus).

II. *CUSCUTOIDEAE* (leafless saprophytes; embryo without cotyledons): *Cuscuta* (only genus).

[Placed in Polemoniales by Benth.-Hooker, in Tubiflorae by Warming.]

**Convolvulus** (Tourn.) Linn. Convolvulaceae (I. 4). 160 sp. chiefly temp. *C. arvensis* L. in Brit. (bindweed). It has sweetly scented flrs. which are much more often visited by insects than the large but scentless flrs. of *Calystegia sepium*. Smaller flrs. with short sta. appear on some stocks; these appear to be due to the action of a fungus (cf. *Lychnis* and see *Beih. z. Bot. Centr.*, 1893, p. 447). The root produces adventitious stem buds, by which vegetative multiplication takes place to a large extent. From incisions made in the rhizome of *C. scammonia* L. a resinous juice flows, which is used in medicine as a purgative (Scammony).

**Conyza** Linn. Compositae (III). 50 sp. temp. and subtrop.

**Cooperia** Herb. Amaryllidaceae (I). 2 sp. Mexico, Texas.

**Copaiba** Adans. = *Copaifera* Linn.

**Copaifera** Linn. Leguminosae (II. 2). 16 sp. trop. Am., Afr. Several

- S. Am. sp. yield the resin known as Balsam of Copaiba, and resins (copals) are also obtained from the Afr. sp.
- Copernicia** Mart. Palmae (I. 2). 6 sp. Am. *C. cerifera* Mart. is the wax- or Carnauba-palm of Brazil. Its leaves are coated with wax, which can be removed by shaking; it is used in making candles and is largely imported into Brit. The wood, leaves, &c., are also useful.
- Coprosma** Forst. Rubiaceae (II. 17). 40 sp. N. Z., Austr., Malaya, Chili. The stipules of some sp. are glandular, and some have peculiar openings (?domatia) on the backs of the leaves.
- Coptis** Salisb. Ranunculaceae (2). 8 sp. N. temp. and arctic.
- Corallorhiza** Hall. Orchidaceae (8). 12 sp. N. temp. *C. innata* R. Br. (coral-root) in Brit. Saprophytes with much branched fleshy rhizome, no roots, and scaly leaves. [See p. 195, and cf. *Epipogum*.]
- Corchorus** (Tourn.) Linn. Tiliaceae. 30 sp. trop. *C. capsularis* L. and *C. olitorius* L. (India &c.) furnish the chief supply of the valuable fibre jute or gunny (obtained by steeping the full-grown stems in water; cf. *Linum*). Annual plants about 12 feet high, little branched.
- Cordia** Linn. Boraginaceae (1). 230 sp. trop. Trees or shrubs. The fruit is edible; that of *C. Myxa* L. (Egypt to Austr.) was formerly used in medicine. [See Mez in *Engler's Jahrb.* XII.]
- Cordiaceae** (Warming) = Boraginaceae (suborder 1).
- Cordyline** Comm. Liliaceae (VI). 10 sp. trop. and warm temp. Favourite decorative plants with the habit of *Dracaena*. The leaves of some sp. yield fibre.
- Coreopsis** Linn. Compositae (V). 70 sp. Am., trop. Afr., Sandw. Is.
- Corethrogyne** DC. Compositae (III). 3 sp. Calif.
- Coriandrum** (Tourn.) Linn. Umbelliferae (8). 3 sp. Medit. The fruits (Coriander-seeds) of *C. sativum* L. are used in flavouring.
- Coriaria** Niss. ex Linn. The only genus of Coriariaceae. 8 sp. Medit., India to Japan, N. Z., Chili to Mexico. The genus is thus probably one which was formerly very widely spread over the globe (p. 157). They are mostly shrubs with opp. or whorled leaves, sometimes becoming alt. at the ends of the shoots. The inconspicuous protogynous fls. are borne in racemose infls. K 5, C 5, A 5+5,  $\underline{G}$  5. The petals are keeled on the inner side, and after fertilisation of the flr. grow fleshy and enclose the cpls. forming a pseudo-drupe. Ovules 1 in each loc., pendulous, anatropous; raphe dorsal. Endosperm thin.
- Coriariaeae** (Benth.-Hooker) = Coriariaceae.
- Coriariaceae**. Dicotyledons (Archichl. Sapindales). Only genus *Coriaria* (q.v.). The only nearly related order is Empetraceae. Placed as anomalous order at end of Disciflorae by Benth.-Hooker.
- Coris** Tourn. Primulaceae (V). 2 sp. Medit.
- Corispermum** B. Juss. ex Linn. Chenopodiaceae (6). 10 sp. N. temp.
- Cornaceae**. Dicotyledons (Archichl. Umbelliflorae). 16 gen. with 80 sp., cosmop., but chiefly N. temp. Shrubs with opp. or rarely alt. leaves, usually entire, exstip. Infl. dichasial, usually condensed

into corymb or umbel form, or even (*Cornus*) into heads with involucre. Flrs. usually  $\bar{z}$ , regular, 4—5— $\infty$ -merous. Typical formula  $K_4, C_4, A_4, \bar{G}(2)$ . There is an epigynous disc, and a simple style with lobed stigma. Ovary multi-loc., with usually 1 pendulous ovule in each loc., the raphe of the ovule dorsal. Fruit a berry or more often a drupe, with a 1—4-loc. stone or 2 separate stones. *Chief genera*: *Cornus*, *Garrya*, *Aucuba*.

**Cornucopiae** Linn. Gramineae (VIII). 1 sp. Orient., *C. cucullatum* L. Flrs. in small heads; when the fruit is ripe these bend over and break off with a sharp point. They adhere to animals and are also said to burrow into the soil (cf. *Stipa*).

**Cornus** (Tourn.) Linn. Cornaceae. 25 sp. Eur., As., Am. 2 in Brit., *C. sanguinea* L. the cornel or dogwood, and *C. suecica* L. The flr. of the former is biologically like that of an Umbellifer, but is homogamous. Its berry fruits are eaten by thrushes. The latter is a dwarf herbaceous perennial, common in the Highlands. Annual stems are given off from the creeping perennial stems. Flrs. in umbels with involucre of 4 large white bracts. *C. florida* L. (N. Am.) and others yield useful wood. *C. mas* (*mascula*) L., the Cornelian cherry (Eur., As. Minor), yields a fruit which makes good preserves. Its flrs. appear in spring before the leaves (p. 100).

**Coronarieleae** (Benth.-Hooker). The 3rd series of Monocotyledons.

**Coronilla** Tourn. ex Linn. Leguminosae (III. 7). 20 sp. Eur., Medit., W. As. The flr. resembles that of *Lotus*, but the honey (at least in *C. varia* L. and others) is secreted by the outer surface of the calyx, and insects poke their tongues through between the claws of the petals, which are longer than usual. The buds are bent downwards, the open flrs. project horizontally, the ripening fruits downwards and the ripe fruits usually upwards (p. 101).

**Coronopus** Rupp. ex Linn. = *Senebiera* DC.

**Correa** Andr. Rutaceae (III). 5 sp. temp. Austr. Favourite greenhouse shrubs. Flr. sympetalous.

**Corrigiola** Linn. Caryophyllaceae (II. 4). 6 sp. Medit., Eur. *C. littoralis* L. on coasts of Devon and Cornwall.

**Cortusa** Linn. Primulaceae (I). 1 sp. Mts. of Eur. and As.

**Coryanthes** Hook. Orchidaceae (19). 4 sp. trop. S. Am., epiphytic. One of the most remarkable flrs. in existence. The flr. is pendulous; the sepals are bent back and fairly large, the petals small. The labellum is of a most complex shape; projecting horizontally from the base of the column is a bar bearing a dome on the end, from which is suspended a bucket-like organ; the mouth of the bucket faces upwards, and the edges are incurved; there is also an overflow pipe projecting towards the sepals and closely covered in by the bent end of the column, with the stigma and anther. From the base of the column project two horns which secrete a thin watery fluid that drips into the bucket, keeping it full to the level of the overflow pipe.

The dome (above) is composed of succulent tissue very attractive to bees; these fight for places on it whence to drill the tissue; every now and then one of them gets pushed off and falls into the bucket. It can neither fly nor climb out, and so has to squeeze through the overflow pipe. In so doing it first passes the stigma, fertilising it if it bears any pollen, and then, passing the anther, is loaded with new pollinia to be transferred to other flrs. "I have often seen this, and sometimes there are so many of these humble bees assembled that there is a continual procession of them through the passage" (Crüger). [See Darwin's *Orchids*, p. 173, and cf. Stanhopea.]

**Corydalis** Vent. Papaveraceae (111). 90 sp. Medit., Eur., As. *C. claviculata* DC. in Brit., a (leaf) tendril-climbing annual. Most are perennial herbs with underground tubers. In *C. cava* Schweigg. and Kort., and other sp. the main axis forms a tuber, which dies away below, each annual shoot arising from the axil of a scale-leaf of older date. In *C. solida* Sw., and others, the tuber is a swollen root-structure belonging to the current annual shoot. Flr. transversely zygomorphic (see order for diagram); only one petal is spurred and contains the honey secreted by a staminal outgrowth. Twisting of the axis through 90° brings the flr. into a vertical position. Its mechanism resembles that of many Leguminosae. The inner petals, united at the tip, enclose the stigma and anthers; the upper petal covers the flr. Bees alighting push down the inner petal and cause the essential organs to emerge. In some sp., e.g. *C. ochroleuca* Koch and *C. lutea* DC., the emergence is explosive (cf. Genista). The flrs. of *C. cava* are self-sterile (p. 87).

**Corylopsis** Sieb. et Zucc. Hamamelidaceae. 6 sp. China, Japan. Flrs. ♂, in spikes with coloured bracts at base.

**Corylus** (Tourn.) Linn. Betulaceae. 7 sp. N. temp. *C. Avellana* L., the Hazel-nut (Brit.) is the most familiar. The general habit is shrubby (largely owing to the extensive formation of suckers), with catkinate flrs. (the ♀ catkin sessile and elliptical in outline, rather resembling a bud). Both are laid down in autumn; the ♂ catkins are visible all winter on the bushes, but the ♀ are not obvious until the red stigmas come out early in the year. Like other catkinate plants they are anemophilous, and the fact of flowering before the appearance of the leaves renders their chance of fertilisation much greater. On the inner side of the bract in the ♂ catkin are found 2 scales and, adnate to these, 4 sta., each branched nearly to the base. There is present here only the central flr. of the possible 3 (cf. diagram of order), with its bracteoles  $\alpha$ ,  $\beta$ . In the ♀ catkin, on the other hand, we have the two laterals and not the central flr. as shown in the diagram overleaf (\* = missing flr.). At the time of fertilisation, the ovary is very minute, but the long red stigmas are easily identified. After fertilisation, the ovary (2-loc.

|          |        |         |
|----------|--------|---------|
|          | stem   |         |
| *        | ♂ flr. | *       |
| $\alpha$ |        | $\beta$ |
|          | bract  |         |

at first) gives a one-seeded nut, enclosed in a cup of green leafy nature, which is really the combined bract and bracteoles  $\alpha$ ,  $\alpha'$ ,  $\beta'$ , very much developed. The flr. is chalazogamic (see art. *Chalasogamæ*). The nuts of this and other sp. are valuable as dessert fruit &c. (hazel-nut, cob-nut, filbert). The wood is elastic, but cannot be obtained in large boards. Oil is expressed from the seeds.

|                           |       |                            |
|---------------------------|-------|----------------------------|
|                           | stem  |                            |
| $\alpha'$                 |       | $\alpha'$                  |
| $\alpha \varnothing$ flr. | *     | $\varnothing$ flr. $\beta$ |
| $\beta'$                  |       | $\beta'$                   |
|                           | bract |                            |

**Corynephorus** Beauv. (*Weingaertneria* Bernh.). Gramineae (1x). 3 sp. Eur. *C. canescens* Beauv. (*W.* or *Aira canescens*) in Brit.

**Corypha** Linn. Palmae (1. 2). 6 sp. Ceylon, Indo-mal. The infl. terminates the life of the tree and is of gigantic size. *C. umbraculifera* L. is the Talipot palm of Ceylon; it grows to a great size (up to 100 feet in height). The leaves are used as umbrellas, and for thatching, also as writing material (a metal stylus being used).

**Cosmanthus** Nolte = *Phacelia* Juss.

**Cosmibuena** Ruiz et Pav. (1802). Rubiaceae (1. 4). 6 sp. trop. Am. There is good bud-protection by means of the stipules of the last-opened leaves.

**Cosmibuena** Ruiz et Pav. (1794) = *Hirtella* Linn. (Rosaceae.)

**Cosmos** Cav. (*Cosmea* Willd.). Compositae (v). 20 sp. Am.

**Costus** Linn. Zingiberaceae. 25 sp. trop. Am., W. Afr., As., Austr. The labellum is very large, the lateral staminodes wanting, the sepals and petals comparatively small. Projecting in the centre of the flr. is the fertile petaloid sta. with the anther on its anterior face; the style reaches just above this. The floral mechanism thus resembles that of Iris.

**Cotinus** (Tourn.) Linn. = *Rhus* Linn. *C. coggrygia* Scop. = *R. Cotinus*.

**Cotoneaster** Rupp. Rosaceae (11. 4). 30 sp. N. temp. *C. vulgaris* Lindl. was till lately found on the Great Orme's Head near Llandudno, but is now extinct in Brit. In the Alps the flr. is visited solely by a wasp (*Polistes gallica*) whose nests are often found attached to the rocks where the plant is growing. The flr. is protogynous with self-fertilisation in default of insect visits. Several sp. are favourites in shrubberies &c.

**Cotula** (Tourn.) Linn. (excl. *Cenia* Juss.). Compositae (vii). 50 sp. S. Hemisph., Medit., As., N. Am.

**Cotyledon** Tourn. ex Linn. (incl. *Echeveria* DC.). Crassulaceae. 90 sp. Afr., Eur., As., Mexico, S. Am. *C. Umbilicus* Linn. (penny-wort) in Brit. Petals united into a tube. Leaves succulent. [*Linn. Soc. Journ.* xxx. p. 292.]

**Coumarouna** Aubl. = *Dipteryx* Schreb.

**Couratari** Aubl. Lecythidaceae. 8 sp. S. Am. The bark yields a soft fibre used for making clothing.

**Couroupita** Aubl. Lecythidaceae. 9 sp. trop. S. Am. The flrs. of *C. guianensis* Aubl., the commonest sp., are borne on the old stems

(p. 200), and followed by large spherical woody capsules (whence the name of cannon-ball tree).

**Cousinia** Cass. Compositae (XI). 210 sp. Orient.

**Crambe** Tourn. ex Linn. Cruciferae (II. 10). 20 sp. Eur., Medit., As., Polynes., Patagonia. *C. maritima* L. (sea-kale) on the coast of Brit. Its leaves are fleshy and coated with wax (p. 187). The young leaves, blanched by tying them together, form a favourite vegetable.

**Crantzia** Scop. = *Alloplectus* Mart.

**Crassula** Dill. ex Linn. (excl. *Dinacria* Harv., and *Tillaea* Michx.).

Crassulaceae. 100 sp. S. Afr., a few Abyss. and Himal. Chiefly succulent-leaved xerophytes. In *C. lycopodioides* Lam. the leaves are narrow and closely packed, giving to the plant the habit of a Lycopodium. In *C. falcata* Wendl. (*Rochea falcata* DC.) the connate decussate leaves stand almost edgewise. They are very fleshy and have a peculiar covering upon the surface; some of the epidermal cells are swollen above the rest into large bladders which meet one another over the whole surface. At first these are living and contain water, but when the leaf is mature they are dead and full of air, whilst their walls are infiltrated with quantities of silica. An effective protection against excessive evaporation is thus afforded. In *C. nemorosa* Endl. there is vegetative reproduction (p. 115) by the formation of young plants in the infl. in place of flrs.

**Crassulaceae.** Dicotyledons (Archichl. Rosales). 15 gen. with 450 sp. cosmop., but chiefly in S. Afr. They form a very natural group. Most are perennials living in dry (especially rocky) places and exhibit xerophytic characters, fleshy leaves and stem, often tufted growth, close packing of leaves upon one another, waxy surface, sunk stomata, &c. (see p. 178). Vegetative reproduction is frequent; it is usually effected by means of rhizomes or offsets; some sp. form bulbils, &c. (e.g. *Crassula*), others form adventitious buds upon the leaves (e.g. *Bryophyllum*). Flrs. usually in cymes (cincinni),  $\bar{\sigma}$  or rarely unisexual, actinomorphic with very regular construction. The formula may be thus given,  $K_n, C_n, A_n + n, \underline{G}_n$ , where  $n$  represents any number from 3 to 30. Calyx persistent. Corolla sometimes (e.g. *Cotyledon*) gamopetalous. Sta. frequently obdiplostemonous. The insertion of parts is usually perigynous, but the receptacle is not deeply hollowed. Cpls. frequently slightly united at the base. At the base of each there is commonly a honey-secreting scale. Ovules usually  $\infty$ . Fruit usually a group of follicles with very small seeds. Endosperm none or very little. The flrs. are mostly protandrous and chiefly visited by flies, &c., their honey being easily obtainable. The chief genera are thus grouped by Schönland (in *Nat. Pfl.*) around *Sedum*:

$$\text{Sedum} \begin{cases} \text{Sempervivum} \\ \text{Cotyledon} \rightarrow \text{Bryophyllum} \\ \text{Crassula} \end{cases}$$

[Placed in Rosales (Benth.-Hooker); Saxifraginae (Warming).]



**Crataegus** Tourn. ex Linn. [United to *Mespilus* in *Nat. Pf.* The boundaries of these two genera and of *Pyrus* are ill-defined.] Rosaceae (II. 4). About 60 sp. N. temp. *C. Oxyacantha* L. (hawthorn or may) in Brit. The thorns are modified branches. The wood is regarded as a good substitute for that of box in engraving &c.

**Crataeva** Linn. Capparidaceae (III). 10 sp. trop.

**Cratoxylon** Blume. Guttiferae (II). 12 sp. Indo-mal.

**Crepis** (Vaill.) Linn. (incl. *Barkhausia* Moench). Compositae (XIII). 170 sp. N. Hemisph. 6 in Brit. (hawk's beard). Like *Hieracium*.

**Crescentia** Linn. Bignoniaceae (IV). 5 sp. trop. Am. The flrs. are borne on old stems (p. 200) and are succeeded by the gourd-like berries. The epicarp is woody and after removal of the pulp forms a useful calabash (*C. Cujete* L., the calabash tree, is most used).

**Crinum** Linn. Amaryllidaceae (I). 70 sp. trop. and sub-trop., chiefly on sea-coasts. Large and handsome bulbous plants with showy flrs. (? visited by humming-birds). The seed of *C. asiaticum* L., according to Goebel (*Pflanzenbiol. Schild.* I. p. 128), has only a very thin corky covering and is adapted to distribution by water and early germination. The ovule has no integuments, and the want of a testa is replaced by a formation of cork at the outside of the endosperm.

**Cristaria** (Heist.) Cav. Malvaceae (II). 25 sp. Chili, Peru.

**Crithmum** Linn. Umbelliferae (6). 1 sp., *C. maritimum* L., the samphire, on rocky coasts, Medit., Eur. (incl. Brit.). It has much divided and very fleshy leaves (p. 187). It is used for making pickles.

**Crocasmia** Planch. Iridaceae (III). 1 sp., *C. aurea* Planch., trop. and S. Afr. United to *Tritonia* in *Nat. Pf.*

**Crocus** (Tourn.) Linn. Iridaceae (I). 60 sp. Medit., Eur., 2 sp. naturalised in Brit. Below ground is a corm, covered with a few scaly leaves, in whose axils may arise one or more buds, giving rise to new corms on the top of the old. The leaves are dorsiventral, and curiously grooved on the back. The flr. is often single and terminal; in some sp. there is a small cyme of flrs. The tube of the perianth is so long that the ovary remains below the soil and is thus protected from the weather (cf. *Colchicum*). The flr. is protandrous and visited by bees and Lepidoptera. Honey is secreted by the ovary, and the anthers face outwards so as to touch any insect alighting on the petals and seeking honey. The stigmas are branched. Birds often bite off the flrs. in gardens (? for honey); they seem to prefer the yellow flrs., leaving the blue and white alone. [See Schumann in *Bot. Zeit.* 1894.]

The dried stigmas of *C. sativus* L. form saffron, once largely used as an orange-yellow dye, but now chiefly employed in flavouring and colouring dishes, liqueurs, &c. [See Kronfeld's *Geschichte des Safrans* &c., Wien 1892, or *Beih. z. Bot. Centr.* 1893, p. 71.]

**Crossandra** Salisb. Acanthaceae (IV. B). 17 sp. trop. As., Afr.,

Madag. The seeds of many sp. are covered with scales which spread out and become sticky when wetted, thus anchoring them to suitable places for germination (cf. *Linum*).

**Crotalaria** Dill. ex Linn. Leguminosae (III. 3). 250 sp. trop. and sub-trop. *C. juncea* L. (India, Austr.), an annual plant growing about 8 ft. high, is largely cultivated for the fibre obtained from its stems by maceration in water (cf. *Linum*), and known as Sunn-hemp, Bombay or Madras hemp, &c. *C. retusa* L. (trop.) is also employed and probably other sp. would be found useful.

**Croton** Linn. Euphorbiaceae (A. II. 1). 600 sp. trop. Flrs. mon- or di-œcious, comparatively little reduced in structure from the primary type of the order. *C. Tiglium* L. (trop. As.) is the source of croton oil (a very powerful purgative drug, expressed from the seeds). *C. Cascarilla* Benn. yields Cascarilla bark, used as a tonic (see Cascarilla). *C. lacciferus* L. (India, Ceylon), yields a lac-resin, used in varnish-making.

**Crucianella** Linn. Rubiaceae (II. 21). 4 sp. Eur., Medit. For *C. stylosa* of gardens see Phuopsis.

**Cruciferae.** Dicotyledons (Archichl. Rhœadale-). About 200 gen. with 1200 sp., cosmop., but chiefly N. temp. and esp. Medit. They form a very natural family, well marked off from all others, though approaching nearly to Papaveraceae and Capparidaceae. Most are herbs, a few undershrubs; some annuals, many perennials, forming each year a new shoot terminating in the infl. Leaves usually alt., exstip., with unicellular simple or branched hairs. For other peculiarities of the vegetative organs see genera, e.g. *Brassica*, *Anastatica*, *Subularia*, *Vella*, &c. The infl. is usually a raceme or corymb, and nearly always without either bracts or bracteoles.

Flr. usually ♂, regular, hypogynous, with typical formula  $K\ 2 + 2, C\ 4, A\ 6, \underline{G}\ (2)$ . The calyx has two whorls, the corolla only one, alternating with the calyx as a whole. The petals usually spread out in the form of a cross and are often clawed. The sta. are in two whorls, an outer of 2 short, an inner of 4 long, sta. (tetradynamous); anthers introrse. The two cpls. are placed transversely, and have parietal placentae, but the ovary is 2-loc. on account of the presence of an antero-posterior partition, the *replum* or so-called spurious septum, an outgrowth of the placentae. Stigmas 2, on short style, above the placentae (cf. Papaveraceae). Ovules anatropous or campylotropous.



Floral Diagram  
(after Eichler).

The explanation of the morphology of this flr. has given rise to much dispute and no agreement has been arrived at. It is often regarded as a typically 2-merous flr. (cf. Papaveraceae), and the 4

petals and 4 inner sta. are supposed to be due to branching. Others again regard it as 4-merous (see e.g. Klein in *Bot. Centr.* 58, p. 197). A full discussion of the point may be found in Eichler's *Blüthendiagr.* or in Asa Gray's *Struct. Bot.* p. 206.

On the bases of the sta. are the nectaries, the honey being secreted into the often gibbous bases of the inner sepals. The sepals often stand almost straight up, and the petals are then provided with claws and spread out horizontally beyond the sepals. The honey is thus concealed to some extent and protected from rain. The majority of the order exhibit this construction more or less, thus coming into the biological group of flowers AB (see p. 65). In many genera the flrs. are arranged in corymbs, thus getting the advantage of many flrs. being massed together on one level (cf. Umbelliferae and Compositae). Insects visiting the flrs. touch the anthers with one side of their bodies and the stigma with the other, and may in this way effect cross-fertilisation, as they go sometimes to one, sometimes to the other, side of the flr. Dichogamy is frequent, but not well marked, and in almost all cases self-fertilisation ultimately occurs. [For details see Müller, *Fert. of Flrs.*]

The fruit is a capsule of pod-like form; if it be at least three times as long as it is broad it is called a *siliqua*, if shorter it is called a *silicula*. It is divided into two by the replum and is usually thin and membranous. Dehiscence occurs by the valves breaking away from below upwards, leaving the replum with the seeds pressed against it and adhering. The fruit may be flattened in two ways, either parallel to or at right angles to the replum; this character is of systematic importance. It may also be jointed between the seeds as in a lomentum (Leguminosae). Achene-like one-seeded fruits occur in a few genera. Others have subterranean fruits (Cardamine sp. &c.).

The characters of the seed are also of great importance in the classification of the order. The seed is exalbuminous: the testa is very often mucilaginous, swelling up when wetted (e.g. the familiar case of mustard seed); this property is valuable for fixing the seed in a favourable spot for germination. The ovules being campylotropous, the embryo sacs, and thus the embryos, are curved, usually with the radicle in one half of the seed, the cotyledons in the other. The shape of the embryo and the position of the radicle with regard to the cotyledons are of much importance. The chief cases are: (1) *radicle incumbent* (or embryo *notorhizal*) i.e. lying on the back of one cotyledon, the cotyledons not being folded on themselves; this may be shown thus  $\circ\parallel$ , the  $\circ$  representing the radicle; (2) *accumbent* (or embryo *pleurorhizal*),  $\circ=$ , the radicle against the edges of the cotyledons; (3) *orthoplocous* (cotyledons *conduplicate*),  $\circ>>$ ; (4) *spirolobous*, as in (1) but cotyledons once folded,  $\circ\parallel\parallel$ ; (5) *diplecolobous*, ditto twice or more folded,  $\circ\parallel\parallel\parallel$ .

For plants of economic value see especially Brassica, Nasturtium,

*Lepidium*, &c. All *C.* are harmless, and most are rich in sulphur compounds (to which the smell of boiling cabbages is due), and are thus useful in scurvy &c.

*Classification and chief genera* (after Prantl):

The grouping of the smaller divisions of the order and the defining of the genera is a most difficult task. Many classifications have been devised. Prantl (in *Nat. Pfl.*) bases his largely upon the hairs borne on the leaves. Others rely on characters of fruit and embryo &c. In any case the identification of a cruciferous genus is a difficult matter; we shall not here go into the details of the classification, but merely give Prantl's groups and the chief genera belonging to them.

A. Hairs simple or none: no glandular hairs.

I. *Thelypodieae* (stigma equally developed all round; style undivided or prolonged above middle of cpls., or turned back).

1. Stanleyinae: Pringlea, Thelypodium.
2. Cremolobinae: Cremolobus.
3. Heliophilinae: Heliophila.
4. Chamirinae: Chamira.

II. *Sinapeae* (stigma better developed over placentae).

5. Lepidiinae: Subularia, Lepidium.
6. Cochleariinae: Iberis, Cochlearia.
7. Alliariinae: Alliaria.
8. Sisymbriinae: Sisymbrium, Cakile, Isatis.
9. Vellinae: Vella.
10. Brassicinae: Sinapis, Brassica, Crambe.
11. Cardamininae: Nasturtium, Cardamine.

B. Hairs branched (a few exceptions): sometimes also glandular hairs.

III. *Schizopetaleae* (stigma equal all round).

12. Schizopetalinae: Schizopetalum.
13. Physariinae: Physaria.

IV. *Hesperideae* (stigma better developed over placentae).

14. Capsellinae: Capsella, Draba.
15. Turratinae: Arabis.
16. Erysiminae: Erysimum, Cheiranthus.
17. Alyssinae: Alyssum.
18. Malcolmiinae: Anastatica, Malcolmia.
19. Hesperidinae: Hesperis, Matthiola.
20. Moricandiinae: Conringia.

[Placed in Parietales by Benth.-Hooker, in Rhoeadinae by Warming.]

**Cryptadenia** Meissn. Thymelaeaceae. 5 sp. Cape Col.

**Cryptanthus** Otto et Dietr. Bromeliaceae (1). 6 sp. Brazil. Cultivated for their variegated leaves.

**Cryptocarya** R. Br. Lauraceae (11). 40 sp. trop. and subtrop. The fruits of *C. moschata* Nees et Mart. are known as Brazilian nutmegs, and used as spice.

**Cryptocoryne** Fisch. Araceae (VII). 20 sp. Indo-mal. Marsh plants. Some sp. are apparently 'viviparous' in their germination, like mangroves (p. 189, and see Goebel's *Pflanzenbiol. Schild.* 1. p. 132).

**Cryptogamae.** A term used to distinguish those plants which are not Phanerogams, or in other words do not produce seeds. All the higher C. exhibit Alternation of Generations (see art. *Pteridophyta*), and the distinction between them and P. depends on the fact that in C. the *macrospore or spore falls out of its sporangium*, germinates upon the ground or in water and gives rise to an *independent* ♀ (or ♂) prothallus; in the P. (*q. v.*) on the other hand, the macrospore (embryosac) does not fall out of its sporangium (ovule) nor become independent. The result is the formation of a seed.

The C. are fertilised by aid of usually motile ♂ cells (anthero- or spermato-zoids) instead of the pollen-tubes of P.

The C. are divided into 3 great groups, Thallophyta, Bryophyta, and Pteridophyta, each usually regarded as equivalent to Phanerogams (see p. 133). With the first two groups this book does not deal. For further details of C. see Pteridophyta (where further references will be found) and Campbell's *Mosses and Ferns*.

**Cryptogamae Vasculares** = Pteridophyta.

**Cryptogramme** R. Br. (*Allosorus* Bernh.). Polypodiaceae. 1 sp. N. temp., esp. Alpine, *C. crispa* R. Br., the parsley fern or curled rock-brake, common in some districts of Brit.

**Cryptomeria** D. Don. Coniferae (Arauc. 1 c; see C. for genus characters). 1 sp., *C. japonica* D. Don (Japan, China), the Japanese cedar, often cultivated. The timber is valuable.

**Ctenanthe** Eichl. Marantaceae. 7 sp. trop. Am.

**Cucubalus** (Tourn.) Linn. Caryophyllaceae (1. 1). 1 sp. *C. baccifer* L., N. temp. (introd. in Brit.). Fruit a berry.

**Cucumis** (Tourn.) Linn. Cucurbitaceae (III). 26 sp. trop. and sub trop. *C. Melo* L. is the melon, *C. sativus* L. the cucumber, both cultivated from the earliest times. The tendrils are simple and are regarded as of leaf nature (see order), the stem portion being suppressed.

**Cucurbita** (Tourn.) Linn. Cucurbitaceae (III). 10 sp. Am., but many have been so long cultivated that their origin is doubtful. For the tendrils see order. Flrs. monœcious. The germination is interesting. On the lower side of the hypocotyl a peg is formed which holds one side of the testa firmly while the expansion of the plumule splits off the other side. The position of the peg is determined by gravity; if the seed be revolved on a klinostat during germination a ridge is formed all round the hypocotyl. Hence these seeds should always be sown with the flat surfaces horizontal.

*C. Pepo* L. is the pumpkin, with its varieties the vegetable marrow and squash; *C. maxima* Duchesne the giant pumpkin, largely cultivated in N. Am.

**Cucurbitaceae.** Dicotyledons (Sympet. Campanulatae). 87 genera with about 650 sp. found in most parts of the world, but wanting in the colder regions and most abundant in the tropics. They are chiefly climbing annual herbs with very rapid growth and great abundance of sap in their stems and other tissues. They climb by tendrils, about whose morphological nature there has been much discussion; for they have been considered by various authors as "roots, stems, leaves, stipules, shoots, flower-stalks or organs sui generis." According to Müller (*Nat. Pfl.*) the tendrils of *Cucurbita Pepo*, with their frequent abnormalities, give a proof of their true nature. Every variety is found, from simple threads to long leafy tendrils, in which the leaves show all transitions to tendrils. Müller, therefore, considers the twining portion of the tendril to be a metamorphosed leaf, the lower stiff portion a stem. The tendrils of C. are very sensitive and show very well all the phenomena of tendril-climbing.

The flrs. are declinous, rarely ♂, in infls. of various types (see *Nat. Pfl.*, or Eichler, *Blüthendiagr.*).

The calyx and corolla are typically 5-merous, regular, with cohesion in both whorls. The sta. are typically 5, but great variety is introduced into the andrœceum by cohesions &c.; it is almost always zygomorphic. In *Fevillea* we find 5 sta. with bilocular anthers, the simplest type; it is noteworthy that the usual 4-locular anther never occurs in C., and no trace of the missing loculus is to be found in either lobe of the anther of *Fevillea*. In the rest of the order the andrœceum is more complex. In *Thladiantha* two pairs of sta. stand apart from the fifth sta. In *Sicydium* these pairs show union of their members at the base, and in others of the order the union is more complete, until, as in *Bryonia* &c., the andrœceum apparently has only 3 sta., of which 2 have 4-locular anthers. The more the sta. depart from the simple type the more curved do the loculi of the anthers become, till in *Cucurbita* &c. the pollen-sacs are twisted in a most extraordinary manner (cf. *Columellia*). In *Cyclanthera* the sta. are all united into a column with two ring-shaped pollen chambers running round the top (cf. the *flowers* of *Cyclanthus*).

The ovary is inferior, 1—10-loc., with 1—∞ anatropous ovules in each loc.; the most common type is, however, a 3-loc. ovary with axile placentae projecting deep into the cavity. Stigmas as many as cpls., usually forked.

Fruit nearly always fleshy, of the type exhibited in the melon or cucumber—a berry-like fruit, sometimes called a pepo. The seeds are exalbuminous. In *Zanonia*, *Ecballium*, *Cyclanthera*, &c. (q. v.), the mode of seed-dispersal is interesting.

The relationships of this order have been much disputed. Benth.-Hooker place it near *Passifloraceae*, Baillon near *Loasaceae* and *Begoniaceae*. It is now pretty generally accepted however that it comes near to the *Campanulaceae*, as here placed.

Many are valuable on account of their fruits, e.g. *Cucurbita*, *Sechium*, *Luffa*, *Lagenaria*, &c.

*Classification and chief genera* (after Pax):

A. Pollen-sacs not fused into a ring.

a. Sta. free or only united at base.

I. *Fevilleae* (sta. 5, rarely 4): *Fevillea*, *Zanonia*, *Thladiantha*.

II. *Melothricae* (sta. 3, rarely 2 or 4; pollen-sacs straight or slightly curved): *Melothria*, *Telfairia*.

III. *Cucurbitae* (do., but pollen-sacs S or U shaped): *Acanthosicyos*, *Momordica*, *Luffa*, *Bryonia*, *Ecballium*, *Cucumis*, *Lagenaria*, *Trichosanthes*, *Cucurbita*.

b. Sta. united into a column.

IV. *Sicyoideae*: *Echinocystis*, *Sechium*, *Sicyos*.

B. Pollen-sacs fused into a ring.

V. *Cyclanthereae*: *Cyclanthera* (only genus).

**Gulcitium** Humb. et Bonpl. Compositae (VIII). 14 sp. Andes. Like *Espeletia* (q. v.).

**Cullenia** Wight. Bombacaceae. 1 sp. India, Ceylon.

**Cuminum** (Tourn.) Linn. Umbelliferae (7). 1 sp., *C. Cuminum* L., Medit. The fruits are known as Cumun seeds, and are sometimes used like Caraway seeds.

**Cunninghamia** R. Br. Coniferae (Arauc. 1 c; see C. for genus characters). *C. sinensis* R. Br. the only sp., in S. China and Cochin-China.

**Cunonia** Linn. Cunoniaceae. 5 sp. New Caled., and *C. capensis* L. S. Afr. It shows good bud-protection by stipules (p. 166).

**Cunoniaceae**. Dicotyledons (Archichl. Rosales). 21 gen. with 120 sp., chiefly found between 13° and 35° S. Shrubs and trees with opp. or whorled leathery leaves, stipulate (the stipules often united in pairs as in Rubiaceae). Flr. small, usually ♂. Receptacle usually flat. K 4—5; C 4—5, usually smaller than calyx, often absent; A 8—10 or ∞ or 4—5; G usually (2), rarely 2. Ovary usually 2-loc., generally with ∞—2 ovules in 2 rows in each loc. Fruit usually a capsule, rarely drupe or nut. Endosperm. *Chief genera*: *Cunonia*, *Weinmannia*. United to Saxifragaceae by Benth.-Hooker; placed in Saxifraginae by Warming.

**Cupania** Linn. Sapindaceae (1). 32 sp. trop. and subtrop. Am. The wood of some sp. is useful. For *C. sapida* Voigt (= *C. edulis* Schum. et Thonn.) see Blighia.

**Cuphea** P. Br. Lythraceae. 160 sp. Am. The leaves are decussate and in most sp. there is one flr. at each node, standing *between* the two leaves. This is really the axillary flr. of the leaf below, and its peduncle is 'adnate' to the main stem. Many sp. are covered with exceedingly sticky glandular hairs.

**Cupressaceae** (Warming) = Araucariaceae § Cupressineae.

**Cupressus** Tourn. ex Linn. [Synonymy: *C. fastigiata* DC. = *C. sempervirens* L.; *C. pendula* Staunt. = *C. funebris* Endl.; *C. nootkatensis*

Lamb. = *Chamaecyparis nutkatensis* Spach.; *C. thujoidea* L. = *Ch. sphaeroidea* Spach.; *C. juniperoides* L. = *Callitris arborea* Schrad.; *C. japonica* L. = *Cryptomeria jap.* Don. See Index Kewensis for further synonyms.]

Coniferae (Arauc. 2c; see C. for genus characters). 12 sp. Medit., As., N.Am. The general habit is xerophytic, the leaves being much reduced and closely appressed to the stems. *C. sempervirens* L. is the cypress of the Medit. region: *C. funebris* Endl. the funereal cypress of China and Thibet, with 'weeping' branches. Several sp. yield useful timber, e.g. *C. Lawsoniana* Murr. (Calif., Oregon), *C. Lindleyi* Klotzsch (Mexico), *C. sempervirens*, &c.

**Cupuliferae.** (Of Benth.-Hooker) = Betulaceae + Fagaceae; (of Warming) = Fagaceae.

**Curculigo** Gaertn. Amaryllidaceae (111). 12 sp. Indo-mal., N. Austr.

**Curcuma** Linn. Zingiberaceae. 30 sp. trop. Afr., As., Austr. *C. angustifolia* Roxb. furnishes east indian arrowroot from its tubers. *C. longa* L. yields the yellow dye turmeric, consisting of the dried and ground rhizome. The tubers of *C. Zedoaria* Rosc. yield Zedoary, used in the East as a tonic and perfume.

**Curtisia** Ait. Cornaceae. 1 sp. S. Afr., *C. faginea* Ait., yielding a hard and useful timber (assegai-wood).

**Curvembryae.** The 1st series (Benth.-Hooker) of Monochlamydeae. The 7th cohort (Warming) of Choripetalae.

**Cuscuta** (Tourn.) Linn. Convolvulaceae (11). 90 sp. trop. and temp. Many sp. have largely extended their boundaries through being carried about with their host plants. Leafless and rootless total parasites. The stem twines and is sensitive to contact like a tendril so that it clasps the support tightly; it rarely makes more than three turns about the same branch of the host. At the points in close contact with the host suckers are developed which penetrate the tissues of the host, growing into organic union with them and drawing off all the food materials required by the parasite, which has no green tissue of its own. The seeds of *C.* germinate later than those of the host plant; a very short anchorage root is formed and the stem nutates in search of a host; as soon as it has clasped one the root dies away. Much damage is often done by these plants: most of the sp. that occur in Brit. (known as dodder, scald, &c.) confine themselves to particular host plants, but others attack a variety of plants. For details see Kerner's *Nat. Hist. of Plants*, vol. 1., and papers by Peirce in *Ann. of Bot.* 1893—4; see also p. 194.

**Cusparia** Humb. Rutaceae (v). 22 sp. S. Am. *C. febrifuga* Humb. (*C. trifoliata* Engl.) yields Angostura or Cusparia bark, sometimes used in place of cinchona bark.

**Cuviera** DC. Rubiaceae (11. 11). 6 sp. W. trop. Afr. Several are ant-inhabited (p. 117) with hollow swellings of the stem above the nodes (see Schumann in *Ber. d. bot. Ges.* IX. 1891, p. 55).



**Cyamopsis** DC. Leguminosae (III. 6). 3 sp. trop. Afr., As. *C. psoraloides* DC. is largely cultivated in India as fodder (Guar).

**Cyananthus** Wall. Campanulaceae (I. 1). 10 sp. Mts. of mid- and E. As. Ovary superior.

**Cyanotis** D. Don. Commelinaceae. 35 sp. Old World, trop.

**Cyathea** Sm. Cyatheaceae. About 60 sp. trop. and sub trop. Tree ferns, forming a very characteristic feature in the scenery of various regions. *C. medullaris* Sw. (N. Z.) is well known, also *C. dealbata* Sw. from the same region. Their pulpy pith is eaten by the natives.

**Cyatheaceae.** Filicineae Leptosporangiatæ (Homosporous). 9 gen. with 200 sp. chiefly trop. and sub trop. They are mostly tree ferns with stout erect stems, covered with adventitious roots and a palm-like crown of leaves at the top. These show the circinate vernation, &c., very well. The sori are marginal or on the under side of the leaves, naked or with a cup-shaped indusium; the sporangia are shortly stalked and have a complete excentric annulus. *Chief genera* Cyathea, Alsophila, Dicksonia, Hemitelia.

**Cyathodes** Labill. = Styphelia Sm.

**Cybianthus** Mart. Myrsinaceae (II). 30 sp. trop. Am., Philipp. Is.

**Cybistax** Mart. Bignoniaceae (II). 3 sp. S. Am. The leaves of *C. Sprucei* K. Sch. are used as a blue dye, by simply boiling them with the cloth.

**Cycadaceae.** Gymnospermae. 9 genera with about 75 sp. The survivors of a group of plants which in past ages figured largely in the composition of the flora of the earth. They reached their maximum about the end of the Triassic and beginning of the Jurassic period. The C. represent the lowest type of living Phanerogams and remind us, in their appearance and habit, of the tree-ferns. The stem is usually short and stout, only growing to any noteworthy height in *Cycas* itself, and is often tuberously swollen. It has a long primary tap root. In some sp. a sort of felt-work of roots is formed at the base of the stem, and a number of short lateral branches of these stand erect and may emerge from the soil (see *Nat. Pfl.*). At the end of the stem there is usually a crown of leaves, and its lower portion is covered with scales. There are, in all C. except a few sp. of *Macrozamia*, two sorts of leaves, foliage- and scale-leaves. They are borne spirally upon the stem, and alternately with one another, as a rule several circles of scales before each circle of foliage leaves, which they protect in the bud. The scales are really leaf bases whose blades abort. The foliage leaves are very characteristic. They possess usually a thickened, woody, more or less sheathing base, which often persists after the fall of the rest of the leaf. There is a stout rachis or petiole, frequently thorny at the base, the thorns being 'metamorphosed' leaflets. Upon its upper side are two grooves, from which spring the leaflets, which may or may not be opposite to one another; there is usually no terminal leaflet. The leaflets may be entire or

toothed and are usually very rigid and leathery. The nervature is important. Three types occur:

- (1) midrib, no lateral nerves: *Cycas*.
- (2) midrib and lateral nerves: *Stangeria*.
- (3) numerous parallel or wavy, simple or forked nerves running longitudinally: the other genera.

The flrs. are dioecious and usually take the form of *cones*; these are terminal, and so the stem becomes a sympodium, except in *Cycas* ♀, where the stem 'grows through' the flr. (the only case of this phenomenon in Phanerogams). The size of the cones varies considerably. Each consists essentially of a central axis bearing a number of fertile leaves or sporophylls; occasionally the lowest leaves are sterile as in Coniferae. In the ♂ cone, the leaves (scales) are generally of a sort of nail shape (cf. *Equisetum*), and bear *sori* upon the lower side. Each sorus consists of 2—6 sporangia (pollen-sacs), arranged with the lines of dehiscence radiating from the common centre. In the ♀ cone the scale (cpl.) is of somewhat similar shape but bears as a rule only two sporangia (ovules), whose apices are directed towards the axis of the cone. *Cycas* (q.v.) has no proper cone, but the stem bears a whorl of cpls. in place of ordinary leaves. The ovule is of considerable size, orthotropous with one integument. [For details of internal structure of ovule, fertilisation, &c., see text-books, and art. *Gymnospermac.*] The pollen is carried by the wind to the micropyle, where it germinates.

The ovule grows into a large seed; the testa is two-layered, the inner layer woody, the outer fleshy. There is also an endopleura on the seed. The nucellus is reduced to a thin cap on the top of the seed, the bulk of which consists of endosperm, with a straight embryo in the centre. There are 2 cotyledons, usually united at the tips.

The C. are exclusively trop. and sub trop. Of the genera, 4, 7, 8, 9 (see below) are from Am., 3 and 6 Austr., 2 and 5 Afr., whilst *Cycas* is found in E. Ind., Austr., and the islands of Ind. and Pacif. Oceans.

#### *Classification and Genera.*

- I. *Cycadeae* (cpls. with 8—4, rarely 2 ovules; stem growing through the ♀ flr.; leaflet with midrib only): 1. *Cycas*.
- II. *Zamiace* (ovules 2; stem not growing through): 2. *Stangeria* (pinna pinnately nerved); 3. *Bowenia* (leaf bipinnate); 4. *Dioon*; 5. *Encephalartos*; 6. *Macrozamia*; 7. *Zamia*; 8. *Ceratozamia*; 9. *Microcycas*.

[The above account of the order is abridged from that of Eichler in *Nat. Pfl.*]

**Cycas** Linn. Cycadaceae. 16 sp. trop. E. Ind., Austr., Polynes. For genus characters &c., see order. The female plant does not bear a cone, but bears a whorl of cpls. of a woolly brown appearance; in notches upon the margins of these are the naked ovules, usually 4—8

in number. The pith of *C. circinalis* L. (Moluccas) and *C. revoluta* Thunb. (Japan) yields a kind of sago.

**Cyclamen** (Tourn.) Linn. Primulaceae (1v). 10 sp. Eur. (mostly alpine), Medit. *C. europaeum* L. in Brit. (sow-bread). There is a stout corm (p. 162) due to the thickening of the hypocotyl. The perianth-lobes are bent back and the flr. is pendulous, with a loose-pollen mechanism (p. 91) as in *Erica*. After fertilisation the stalk usually coils up spirally drawing the ripening fruit down to the soil (cf. *Vallisneria*); in *C. persicum* Sibth. et Sm. it bends over and forces the fruit into the ground (cf. *Arachis*).

**Cyclanthaceae.** Monocotyledons (Synanthae). 6 gen. with 45 sp. trop. Am.; they help to characterise the flora of this region (p. 203). Climbers, epiphytes, rhizome-herbs, or small shrubs, of palm-like habit, with curious spadix infls. on which the ♂ and ♀ flrs. alternate in various ways (see *Carludovica* and *Cyclanthus*). The order is nearly related to the Palmae, Pandanaceae and Araceae; it is placed in Spadiciflorae by Warming, in Nudiflorae by Benth.-Hooker. *Chief genera*: *Carludovica*, *Cyclanthus*.

**Cyclanthera** Schrad. Cucurbitaceae (v). Over 30 sp. trop. Am. The sta. are combined into a column as in section IV, but here the anther-loculi are fused into 2 ring-shaped loculi running completely round the top of the column. *C. explodens* Naud. has an explosive fruit (cf. *Echallium*); the pericarp is extremely turgid on its inner surface, and the fruit dehisces into valves, each of which rolls back on itself with a violent jerk.

**Cyclanthus** Poit. Cyclanthaceae. A unique genus. 4 sp. trop. Am. The rhizome bears large leaves, forked into two at the top. Infl. terminal on a long stalk (figs. in *Nat. Pl.*), as a large cylindrical spadix with big bracts at the base. The spadix resembles a number of discs piled upon one another, with their edges sharpened to a thin rim. In some sp. two parallel spirals compose the spadix, each with a sharpened edge. In the former case every other disc bears ♂ flrs., in the latter one of the spirals, the other being ♀. The ♂ flrs. occupy a groove at the edge of the rim; each has 6 sta. and no perianth. The ♀ flrs. are embedded in the disc and their ovaries are united into a long continuous chamber running all round the disc and containing numerous placentae. The perianths also are united all round the disc; on their inner sides they bear staminodes. The fruit is multiple, consisting of a number of seeds embedded in a general fleshy mass formed of the ovaries and spadix. Cf. *Carludovica*.

**Cycnoches** Lindl. Orchidaceae (17) 8 sp. trop. Am. The flr. is like that of *Catasetum* in mechanism and polymorphism.

**Cydonia** Tourn. ex Mill. = *Pyrus* Tourn. *C. vulgaris* Pers. = *P. Cydonia* L.; *C. japonica* Pers. = *P. japonica* Thunb.

**Cymbalaria** Medic. = *Linaria* Mill.

**Cymbidium** Sw. Orchidaceae (24). 30 sp. E. Ind., China, Austr., Afr.

**Cynanchum** Linn. (incl. *Vincetoxicum* Rupp.). Asclepiadaceae (II. 2). 100 sp. trop. and temp. Many are twiners, and xerophytes with fleshy stems and reduced leaves. The flrs. are fertilised by carrion-flies which get the pollinia attached to their proboscides.

**Cynara** Vaill. ex Linn. Compositae (XI). 11 sp. Medit. *C. Scolymus* L. is the true artichoke (see *Helianthus*). The young flr.-heads enclosed in the involucre bracts form a valuable pot-herb. *C. Cardunculus* L. is the cardoon, whose leaves are blanched and eaten like those of celery. This sp. has spread over great areas on the Pampas, where it was introduced (p. 120).

**Cynocrambeae** (*Thelygonaceae*). Dicotyledons (Archichl. Centrospermae). An order consisting only of the one genus *Cynocrambe* (*Thelygonum*), which is of so anomalous a character that it has been placed near to Urticaceae (to which it is united by Benth.-Hooker), Phytolaccaceae (to which it is united by Warming), Chenopodiaceae, Begoniaceae, Santalaceae, Monimiaceae, &c. (see *Nat. Pfl.*). For details see *Thelygonum*.

**Cynocrambe** Tourn. ex Adans = *Thelygonum* Linn.

**Cynodon** Rich. Gramineae (XI). 3 sp. Austr., the other, *C. Dactylon* Pers., the dog's-tooth or Bermuda grass, cosmop. (incl. Brit.). It grows with creeping stems on sandy soil and is used for binding dunes (p. 187); it forms a useful pasture on such soils. Spikes digitate, spikelets 1-flowered.

**Cynoglossum** (Tourn.) Linn. Boraginaceae (IV. 1). 50 sp. temp. and subtemp. *C. officinale* L. (hound's tongue) and another in Brit. Formerly officinal. The fruit is hooked.

**Cynometra** Linn. Leguminosae (II. 2). 27 sp. trop. *C. cauliflora* L. is a good example of stem-fruited (p. 200).

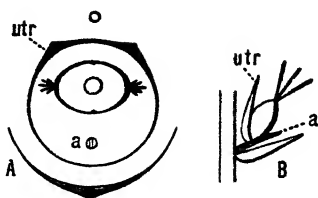
**Cynomorium** Mich. ex Linn. Balanophoraceae. 1 sp. Medit., *C. coccineum* L.

**Cynosurus** Linn. Gramineae (X). 5 sp. Old World temp., 2 in Brit. (dog's-tail grass), one of which, *C. cristatus* L., is a valuable pasture and fodder grass.

**Cypella** Herb. Iridaceae (II. 1). 5 sp. S. Am. One sp. increases its conspicuousness by unfolding its flrs. in great numbers at definite times (F. Müller).

**Cyperaceae**. Monocotyledons (Glumiflorae). 65 genera with over 2500 sp., cosmop., chiefly marsh-plants. Grass-like plants, mostly perennials with creeping sympodial rhizomes. The new shoot of each year is adnate (p. 34), for an internode or more, to the parent shoot, so that the branching seems at first sight extra-axillary. The aerial shoot is usually grass-like, but the stem is generally solid and angular with 3 ranks of leaves. The leaf is sheathing at the base, but the sheath is entire, not split as in a grass. The unit of infl. is again a spikelet; the total infl. may be a spike or panicle as in grasses. In many sedges the spikelet is cymose—a sympodium—and should

perhaps be termed a pseudo-spikelet. The flr. is borne in the axil of a glume and may be ♂ or uni-sexual; it is usually naked but may have a perianth of 6 (or  $\infty$ ) small scales or hairs. Sta. 3, cpls. (3) or (2) forming a 1-loc. ovary, with long feathery (anemophilous) stigmas. Ovule 1, basal, anatropous. In *Carex* &c. the ♀ flr. is borne in the axil of a second glume (the *utricle*) which closely enwraps it (in the figure it is shown diagrammatically). The flrs. are wind-pollinated. Fruit an achene, the testa not adhering to the pericarp. The sedges are of little economic value; see *Cyperus*.



Diagrams of *Carex* (after Eichler). A, diagram of a 2-carpelled ♀ flr., B, side view of ♀ flr. a = axis of spikelet, utr = utricle.

*Classification and chief genera* (after Pax):

I. *SCIRPOIDEAE* (spikelets with no terminal flr., always 2-sexual; flr. almost always ♂): *Cyperus*, *Eriophorum*, *Scirpus*, *Eleocharis*, *Fimbristylis*.

II. *CARICOIDEAE* (spikelets 1-sexual or andro-monoecious; flr. rarely ♀, usually monoecious; ♂ and ♀ flrs. on axes of different orders): *Schoenus*, *Rhynchospora*, *Carex*.

[C. are placed in *Glumaceae* by Benth.-Hooker, *Glumiflorae* by Eichler.]

**Cyperus** Linn. (incl. *Mariscus* Gaertn.). *Cyperaceae* (1). 400 sp. trop. and warm temp. (2 in S. England, rare). Herbs with sympodial rhizome and leafless or leafy shoots above ground. Infl. umbel- or head-like. The most interesting sp. is *C. Papyrus* L., the paper-reed, a river-side plant with shoots 3—12 feet high. From the stems was made the ancient writing paper, papyrus. The stem was split into thin strips and these were pressed together while still wet. The rhizome is edible, and also the root-tubers of several sp.

**Cyphia** Berg. *Campanulaceae* (11). 20 sp. Afr. [*Cyphiaceae*, Warming.]

**Cyphokentia** Brongn. *Palmae* (iv. 6). 10 sp. New Caled.

**Cyphomandra** Mart. ex Sendtn. *Solanaceae* (11. 5). 30 sp. S. Am.

**Cypripedium** Linn. *Orchidaceae* (2). 20 sp. N. temp. and subtrop. (*C. Calceolus* L. in Brit.). Lady's-slipper orchids. Terrestrial acranthous plants. The lateral sepals are completely united. The labellum is slipper-like with inturned edge; at its base is the column, partly enclosed in it. The large staminode (see order) is visible outside the labellum; under it are the two anthers, and lower down the flat stigma. The pollen is glutinous and not united into pollinia. Insects (mostly bees) visiting the flr. get inside the labellum and cannot get out by the way they entered, so have to pass out by the openings at

the base, in doing which they brush first against the stigma and then against the anthers.

**Cyrilla** Garden. *Cyrtillaceae*. 1 sp. Carolina to Brazil, a marsh plant with evergreen leaves, and flrs. in racemes below them.

**Cyrtillaceae**. Dicotyledons (Archichl. Sapindales). 3 gen. with 5 sp. Am. Evergreen shrubs with alt., exstip. leaves and racemes of ♂, regular flrs. K 5, imbricate, persistent; C 5 or (5), imbricate; A 5 + 5 or 5, with introrse anthers; G (5—2), multi-loc. with 1 (rarely 2—4) pendulous anatropous ovule in each loc.; raphe dorsal, micropyle facing upwards and inwards. Embryo straight, in endosperm. *Genera*: Cliftonia, Costaea, Cyrilla. Placed in Olacales by Benth.-Hooker.

**Cyrtandra** Forst. *Gesneraceae* (1). 180 sp. Is. of Ind. and Pacif. Oceans, As.

**Cyrtanthus** Ait. *Amaryllidaceae* (1). 16 sp. S. Afr.

**Cyrtopodium** R. Br. *Orchidaceae* (16). 3 sp. trop. Am.

**Cyrtostylis** R. Br. *Orchidaceae* (4). 2 sp. Austr., N.Z.

**Cystopteris** Bernh. *Polypodiaceae*. 5 sp. alpine and arctic. *C. fragilis* Bernh. (bladder-fern) is common in Brit. and *C. montana* Link occurs on a few Scottish Mts. In *C. bulbifera* Bernh. adventitious buds on the petioles give rise to new plants.

**Cytinaceae** (Benth.-Hooker) = *Rafflesiaceae* + *Hydnoraceae*. Placed in *Multiovulatae Terrestres*.

**Cytinus** Linn. *Rafflesiaceae*. 2 sp. Afr.

**Cytisus** Linn. (incl. *Sarothamnus* Wimm., excl. *Laburnum* L.). *Leguminosae* (III. 3). 40 sp. Eur., Medit. *C. (S.) scoparius* Link, the broom, in Brit. The leaves in this sp. are reduced to scales and assimilation is chiefly performed by the stems. The flr. has an explosive mechanism; in general principle this is like that of *Genista* (q.v.), but it differs in detail. The style is very long and there are two lengths of sta., so that pollen is shed near the tip of the keel and also about half way along its upper side. The stigma is in the extreme tip of the keel. When an insect alights on the flr. (there is no honey), the keel begins to split from the base towards the tip, and presently the pollen of the short sta. is shot out upon the lower surface of the visitor; immediately afterwards, the split having reached the tip, the other pollen and the style spring violently out and strike the insect on the back. As the stigma touches first there is thus a chance of a cross, if the insect bear any pollen. After the visitor's departure the style bends right round and the stigma comes to occupy a position just above the short sta., so that another chance of cross-fertilisation is afforded if other insects visit the flr. (in most exploding flrs. there is only the one chance). Other sp. of *C.* have simple mechanisms like *Trifolium*. The fruit explodes by a twisting of the valves.

*C. Adami* Poit. is a curious graft-hybrid between *C. purpureus* Scop. and *Laburnum vulgare*. The latter was used as the stock; the

shoots above the graft exhibit hybrid characters (see Darwin, *Variation under Domest.* ch. xi).

**Daboecia** D. Don (or *Dabeocia*). Ericaceae (I. 3). 1 sp. *D. polifolia* D. Don (St Dabeoc's heath), in Atl. Eur. (incl. Ireland).

**Daorydium** Soland. Coniferae (Taxaceae, 3; see C. for genus characters). 12 sp. Malaya, N. Z., Tasm. Most are dicecious. Fruit scales 1 or 2 or more. Seed arillate.

**Dactylis** Linn. Gramineae (x). 1 sp. Eur. (incl. Brit.), Medit., As., *D. glomerata* L., the cock's-foot, a valuable pasture grass.

**Dahlia** Cav. Compositae (v). 9 sp. Mexico. Perennial herbs with tuberous roots. Many varieties of *D. variabilis* Desf. and other sp. are in cultivation; the double forms have the disc florets ligulate as well as the ray (cf. *Chrysanthemum*).

**Dalbergia** Linn. f. Leguminosae (III. 8). 80 sp. trop. Several are lianes. *D. variabilis* Vog. is a shrub with pendulous twigs when growing in the open, but in the forest becomes a liane climbing by aid of short lateral shoots which are sensitive to contact. Many sp. yield valuable wood, e.g. the Indian sp. *D. latifolia* Roxb. (blackwood or East Indian rosewood), and *D. Sissoo* Roxb. (Sissoo).

**Dalea** Linn. Leguminosae (III. 6). 100 sp. Am.

**Dalechampia** Plum. ex Linn. Euphorbiaceae (A. 11. 2). 60 sp. trop. *D. Roesliana* Müll.-Arg. is often grown as a stove plant; it has a very complex infl., whose construction is roughly indicated in the diagram. The whole is enclosed in two large outer bracts (the big brackets), which are coloured pink or white. Above these on the axis is a smaller bract (the little bracket), in whose axil is a 3-flowered cyme of ♀ flrs. (F). Above this is the ♂ part of the infl., starting with 4 bracts (in the positions represented by the asterisks). Above these, anteriorly are 9-14 ♂ flrs. and posteriorly a curious yellow cushion, consisting of rudimentary ♂ flrs. In a sp. described by F. Müller the cushion secretes resin, which is used by bees for nest making, and attracts them to the flr.



**Dalibarda** Linn. = *Rubus* Tourn. *D. repens* L. = *R. Dalibarda* L.

**Damasonium** Mill. Alismaceae. 3 sp. Eur., Austr.

**Dammara** (Rumph) Lam. = *Agathis* Salisb.

**Dampiera** R. Br. Goodeniaceae. 34 sp. Austr.

**Danaea** Sm. Marattiaceae (III). 11 sp. Am. The stem branches, a rare character in M. The synangia are very long, sometimes reaching from midrib to margin of the leaf. They open by a terminal pore.

**Danthonia** DC. Gramineae (ix). 100 sp. trop. and temp., esp. S. Afr.

**Daphnales** (Benth.-Hooker). The 5th series of Monochlamydeae.

**Daphne** Tourn. ex Linn. Thymelaeaceae. 40 sp. Eur., temp. and sub-trop. As.; *D. Mezereum* L., the Mezereon and *D. Laureola* L., the spurge-laurel, in Brit. Honey is secreted by the base of the ovary,

- and the depth of the tube preserves it for long-tongued insects. Several sp. are cultivated.
- Daphniphyllum** Blume. Euphorbiaceae (A. 1. 3). 12 sp. trop. Afr., Indo-mal., China, &c.
- Daphnopsis** Mart. et Zucc. Thymelaeaceae. 25 sp. S. Am., Mexico, W. Ind.
- Darlingtonia** Torr. Sarraceniacae. 1 sp. Calif., a pitcher plant like *Sarracenia*, but with the top of the tube bent over and with a fish-tail-shaped flap in front of the opening.
- Darwinia** Rudge. Myrtaceae (3). 25 sp. Austr. Heath-like shrubs.
- Dasyllirion** Zucc. Liliaceae (VI). 10 sp. Texas, Mexico. Xerophytes of Aloe-like habit with woody, often tuberous, stems, and hard leaves. Flrs. dioecious, in gigantic infl.
- Datisca** Linn. Datisceae. 2 sp. N. Am., W. As.
- Datisceae**. Dicotyledons (Archichl. Parietales). 3 gen. with 4 sp., trop. and temp. Trees or herbs with exstip. leaves and racemes or spikes of regular, usually dioecious, sometimes apetalous flrs. In the ♂ flr.: K 4—9, free or united; C 4—9 or 0; A 4—9 or ∞. In the ♀: K 3—8, united to one another and to the ovary; C 0;  $\bar{G}$  (3—8), with free styles. Ovary 1-loc. with parietal placentae and ∞ anatropous ovules. Capsule. No endosperm. *Genera*: *Datisca*, *Tetrameles*, *Octomeles*. The affinities of *D.* are doubtful (see *Nat. Pfl.*); they are probably most nearly allied to *Begoniaceae*. Benth.-Hooker place them in *Passiflorales*, Warming in *Passiflorinae*.
- Datura** Linn. Solanaceae (III. 6). 15 sp. trop. and warm temp. *D. Stramonium* L., the thorn-apple, is sometimes found as an escape in Brit. It has a 4-loc. ovary (see order) giving a 4-valved capsule covered with spines. The leaves and seeds are used in medicine.
- Daucus** (Tourn.) Linn. Umbelliferae (8). 50 sp. Eur., As., Afr., Am. *D. Carota* L. the carrot, in Brit. The cultivated form has much more fleshy roots than the wild. In the centre of the umbel is usually a red terminal flr. After fertilisation the peduncles all bend inwards until the fruits are ripe and then spread out again to allow the burred mericarps to adhere to animals.
- Davallia** Sm. Polypodiaceae. 80 sp. mostly trop. Sori marginal.
- Daviesia** Sm. Leguminosae (III. 2). 55 sp. Austr.
- Davilla** Vand. Dilleniaceae. 25 sp. trop. Am. The two inner sepals are larger than the rest and grow straight upwards. After fertilisation they grow woody or leathery and enclose the fruit.
- Debregeasia** Gaud. Urticaceae (3). 5 sp. Abyss., S. and E. As. *D. edulis* Wedd. is the *Janatsi* of Japan, yielding edible fruit and useful fibre (cf. *Boehmeria*).
- Decaisnea** Hook. f. et Thoms. Lardizabalaceae. 1 sp. Himal., *D. insignis* H. f. et T., with edible fruit (see Hooker's *Himal. Journal*, chap. xxv.).
- Deguelia** Aubl. = *Derris* Lour.



**Deherainea** Dcne. Myrsinaceae (I). 1 sp. Mexico, *D. smaragdina* Dcne, noteworthy for its large green flrs., which owe their colour to chlorophyll. They have an unpleasant smell and are very probably fertilised by large flies. The young flr. shows the extrorse anthers quite hiding the stigma, but later on the sta. move outwards and rest on the corolla.

**Delphinium** Tourn. ex Linn. Ranunculaceae (2). 120 sp. N. temp. *D. Ajacis* L., the larkspur is found in Brit. and several sp. are cultivated for their flrs. Flrs. zygomorphic in racemes; the posterior sepal is drawn out into a spur containing the spurs of the two posterior petals, in which the honey is secreted. [Cf. this mode of protection with that in *Aconitum*; which is far more frequently robbed by humble-bees.] The flr. is protandrous with movement of the sta., and is fertilised by humble-bees. The open flr. projects horizontally, but subsequently the stalk bends upwards and the follicles stand erect so that the seeds can only escape if they are shaken e.g. by strong wind.

**Dendrobium** Sw. Orchidaceae (21). 300 sp. trop. As., Japan, Austr., Polynes. Epiphytes. Many are favourites in cultivation. For floral mechanism see Darwin's *Orchids*, p. 138.

**Dendrocalamus** Nees. Gramineae (XIII). 9 sp. Indo-mal., China. Large bamboos (see *Bambusa*).

**Dendrochilum** Blume. Orchidaceae (22). 3 sp. Indo-mal.

**Dentaria** (Tourn.) Linn. = *Cardamine* Linn.

**Derris** Lour. (*Deguelia* Aubl.). Leguminosae (III. 8). 40 sp. trop.

**Deschampsia** Beauv. Gramineae (IX). 20 sp. temp. and frigid. *D. caespitosa* Beauv. (*Aira*) and *D. flexuosa* Trin. are common in Brit. (hair grass). They are of tufted growth and are rough fodder grasses.

**Desfontainia** Ruiz et Pav. Loganiaceae. 1 sp. Andes, *D. spinosa* R. et P., a pretty holly-like shrub. Its position in the order is doubtful. The ovary has 5 loculi.

**Desmanthus** Willd. Leguminosae (I. 3). 9 sp. sub-trop. N. Am., 1 Madag.

**Desmodium** Desv. Leguminosae (III. 7). 150 sp. trop. and sub-trop. The most interesting sp. is *D. gyrans* DC. the telegraph plant (the name dates from the days of semaphore telegraphy). During the day, provided the temperature be not below 72°F. the two small lateral leaflets of each leaf move steadily round in elliptical orbits. The meaning of this phenomenon is unknown. See Darwin's *Movements of Plants*. At night the leaves sleep, drooping downwards. Several sp. are useful as fodder plants, and are cultivated like clover.

**Desmoncus** Mart. Palmae (IV. 7). 20 sp. trop. Am. Climbing palms with reedy stems, and hooks like those of *Calamus*.

**Deutzia** Thunb. Saxifragaceae (III). 10 sp. N. temp. Ovary inferior 3—4-loc. The fruit splits septicidally into its cpls. which open each at its apex. The seed is provided with a winged testa, very light.

**Deyeuxia** Clar. = *Calamagrostis* Adans.

**Dialium** Linn. Leguminosae (II. 5). 9 sp. trop. Petals 2, 1, or 0; sta. 2, or rarely 3. *D. guineense* Willd. (trop. Afr.) is the velvet tamarind; the pod is covered with a velvety down and contains an edible pulp. Its wood is useful and resists the action of salt water well. *D. indum* L. (Java) the tamarind plum, and others have also edible fruit.

**Dianella** Lam. Liliaceae (III). 11 sp. trop. As., Austr.

**Dianthera** Gronov. Acanthaceae (IV. B). 70 sp. trop. Am. Included in *Justicia* in *Nat. Pfl.*

**Dianthus** Linn. Caryophyllaceae (I. 2). About 230 sp. Eur., As., Afr., N. Am., but esp. Medit., mostly in dry sunny situations (4 in Brit.—the Pinks). The genus is readily known by the bracts under the calyx. The flrs. are very protandrous, and adapted to butterflies. *D. barbatus* L. is the Sweet William, and *D. Caryophyllus* L. is the parent form of the cultivated Carnation (p. 93).

**Diapensia** Linn. Diapensiaceae. 2 sp., one Himal., the other, *D. lapponica* L., circumpolar boreal. It has a tufted habit, like so many alpine and arctic plants. The flrs. are protogynous.

**Diapensiaceae**. Dicotyledons (Sympet. Ericales). 6 gen. with 9 sp., N. Hemisph., chiefly alpine and arctic. They are evergreen undershrubs, with rosettes of leaves; the flrs. solitary or in racemes, with two bracteoles, ♀, actinomorphic, without a disc. K (5) or 5, C (5) nearly polypetalous, A 5, epipetalous, opposite sepals, with frequently 5 staminodes opp. petals; anthers transverse, each lobe opening by longitudinal slit; pollen simple.  $\bar{G}$  (3) with axile placentae bearing ∞ anatropous or amphitropous ovules; style simple with 3-lobed capitate stigma. Fruit a loculicidal capsule. Embryo cylindrical, endosperm fleshy. *Chief genera*: *Diapensia*, *Shortia*, *Galax*. Placed in Ericales by Benth.-Hooker, in Bicornes by Warming.

**Diascia** Link et Otto. Scrophulariaceae (II. 3). 22 sp. S. Afr.

**Dicentra** Bernh. Papaveraceae (III). 15 sp. As., N. Am. *D. Cucullaria* Bernh. (Dutchman's breeches) and other sp. are favourites in cultivation. The rhizome of many sp. (§ *Cucullaria*) resembles a succession of bulbs, on account of the fleshiness of the scale leaves and of the sheathing bases of the foliage leaves. The materials formed in the leaf during the growing season are stored up in the fleshy base, which survives the winter, while the rest of the leaf dies. The flrs. are in racemes and pendulous. Each of the outer petals is developed into a large pouch at its base, and the sta. (here branched from the very base) follow the outer curve of the pouch. The inner petals are spoon-shaped and cohere at the tip, forming a hood which completely covers the anthers and stigma. The pendulous position and complex structure of the flr. render it specially suited to bees, which hang on to it and probe for honey first one side, then the other (the honey is in the pouches of the petals). In so doing they push aside the hood and

touch the stigma, on which there is usually pollen from the sta. of the flr. itself.

**Dichaea** Lindl. Orchidaceae (30). 5 sp. trop. Am. Monopodial creeping epiphytes with sheathing leaves.

**Dichapetalaceae** = Chaillotiaceae.

**Dichapetalum** Thou. = Chaillotia DC.

**Dichondra** Forst. Convolvulaceae (I. 1). 5 sp. trop.

**Dichopogon** Kunth. Liliaceae (III). 2 sp. Austr.

**Dichopsis** Thw. (*Paladium* Blanco). Sapotaceae (I). 50 sp. Indomal.

*D. Gutta* Benth. et Hook. f. (*P.* or *Isonandra Gutta*) was formerly the chief source of gutta-percha, but owing to the reckless way in which the trees were cut down, it is now extinct except in botanic gardens, and the supply of gutta-percha is obtained from other sp. of *D.* and from Payena, &c. The gutta-percha is now obtained by cutting rings out of the bark and collecting the latex which soon coagulates.

**Dichorisandra** Mikan. Commelinaceae. About 30 sp. trop. Am. The infl. is racemose, an exception in this order. Its branches often break through the base of the leaf-sheath.

**Dichroa** Lour. Saxifragaceae (III). 1 sp. Himal. and China to Java.

**Dichromena** Michx. Cyperaceae (I). 8 sp. Am.

**Dichrostachys** Wight et Arn. Leguminosae (I. 4). 7 sp. trop. As., Afr., Austr. The stipules are thorny, as in *Acacia* sp.

**Dicksonia** L'Hérit. (incl. *Cibotium* Kaulf.) Cyatheaceae. 30 sp. trop. and S. Hemisph. Most are tree ferns, e.g. *D. antarctica* Lahill. (Austr., N. Z.). Sori marginal. The famous Tartarian lamb of early travellers was the rhizome of a sp. of *D.* See *Treas. of Bot.* art. *Cibotium*.

**Dicliptera** Juss. Acanthaceae (IV. B). 60 sp. trop.

**Diclytra** Borckh. = *Dicentra* Bernh.

**Dicoma** Cass. Compositae (XII). 24 sp. Afr., Madag., trop. As.

**Dicotyledones**. One of the two great divisions of Angiospermae (q.v.). It is usually divided into two chief groups, the Archichlamydeae and Sympetalae (see Ch. II).

**Dicranostyles** Benth. Convolvulaceae (I. 2). 2 sp. trop. S. Am.

**Dictamnus** Linn. Rutaceae (II). 1 sp. Eur. As., *D. albus* L. (*D. Fraxinella* Pers.), the dittany or candle-plant. The ethereal oil secreted by the plant is very volatile and inflammable, so that on hot calm days the air round it may sometimes be ignited by a flame and the plant itself burnt. The flr. is zygomorphic; the unripe sta. are curved downwards, and bend upwards to dehisce. The fruit opens elastically.

**Dictyoloma** D.C. Rutaceae (VI). 2 sp. Brazil.

**Dictyosperma** Wendl. et Drude. Palmae (IV. 6). 3 sp. Mascarenes.

**Didymocarpus** Wall. (*Rottlera* Vahl). Gesneriaceae (I). 80 sp. Indomal., China, Madag., Austr.

**Didymochlaena** Desv. Polypodiaceae. 2 sp. trop. Am., Malaya.

**Dieffenbachia** Schott. Araceae (V). 12 sp. trop. Am. Flrs. monocious, naked; the ♂ is a synandrium of 4 or 5 sta. *D. Seguire* Schott

is the 'dumb cane' of the W. Ind.; its juice is very acrid and renders speechless a person who chews a piece of the stem. It was formerly used in torturing slaves.

**Dieleytra** Cham. et Schlecht. = *Dicentra* Bernh.

**Diervilla** Tourn. ex Linn. (*Weigelia* Thunb.). Caprifoliaceae (4). 8 sp. E. As., N. Am. *D. florida* Sieb. et Zucc., and others, are favourite garden shrubs. The flr. is adapted to bees and changes colour after fertilisation (? only the effect of age); see *Ribes*, *Fumaria*, &c.

**Dietes** Salisb. = *Moraea* Linn.

**Digitalis** (Tourn.) Linn. Scrophulariaceae (III. 10). 22 sp. Eur., W. As., Canary Is. *D. purpurea* L., the foxglove, is common in Brit. The flrs. are in racemes, which become one-sided by twisting of the peduncles. They are adapted to fertilisation by bees. The leaves are officinal, containing the poisonous alkaloid digitalin.

**Digitaria** Heist. ex Adans. = *Panicum* Linn.

**Digraphis** Trin. = *Phalaris* Linn.

**Dillenia** Linn. (excl. *Wormia* Rottb.) Dilleniaceae. 25 sp. trop. As. to Austr.

**Dilleniaceae**. Dicotyledons (Archichl. Parietales). 12 gen. with 180 sp., trop. They are especially well represented in the Australian 'scrub' vegetation. Most are trees and shrubs (many lianes) with alt. usually leathery leaves and cymose infl. Flr. ♂. K 5, or 3, 4 or even  $\infty$ , spiral, persistent after flowering; C usually 5; A  $\infty$ , hypogynous, free or united at base. Cpls.  $\infty-1$ , free or more or less united; styles usually free. Ovules  $\infty-1$ , erect, anatropous, with ventral raphe. Placentae usually inconspicuous, unthickened. Seed always with a funicular aril united to the testa. Endosperm copious; embryo small, straight. *Chief genera*: *Hibbertia*, *Dillenia*. Placed in Ranales, with which they have much in common, by Benth.-Hooker, in Cistiflorae by Warming. For details of the interesting floral morphology see *Nat. Pfl.*

**Dimorphandra** Schott. Leguminosae (II. 1). 10 sp. trop. Am.

**Dimorphanthus** Miq. = *Aralia* Tourn.

**Dimorphotheca** Vaill. ex Linn. Compositae (x). 20 sp. S. Afr. There are two kinds of fruit on the head (cf. *Calendula*).

**Dionaea** Ellis. Droseraceae. 1 sp. Carolina. *D. muscipula* Ellis, well known under the name of Venus' fly-trap. It grows in damp mossy places on the 'pine-barrens.' There is a short rhizome bearing a rosette of leaves, which lie close to the soil. Each has a lower and an upper blade; the former may be regarded as a winged petiole, the latter has a quadrangular shape and the margins project as long teeth close together like those of a comb. The two halves of this part of the leaf are bent upwards so as to present a flat V-form in section. The edge of each half is green, the inner part of the surface is covered with reddish dots, which under the microscope are seen to be diges-

tive glands; unless stimulated, no secretion is carried on by them. On each half of the leaf are three long hairs—the trigger-hairs—jointed at the base so that they fold downwards when the leaf closes. The slightest touch given to one of these hairs, or a more vigorous stimulus applied to the surface of the leaf, causes an immediate closing of the two halves of the blade. The teeth cross one another, and if an insect cause the movement, it is thus captured. The closing of the leaf still continues till the two halves are tightly squeezed together. Then the digestive glands commence to secrete a ferment which acts upon the proteids of the prey and renders them soluble, when they are absorbed by the leaf (cf. *Drosera* and see p. 196). When the process is complete the leaf opens out again. [For further details, see Macfarlane in *Contrib. from Bot. Lab. Pennsylv. Univ.* 1. 1892.]

**Dionysia** Fenzl. Primulaceae (1). 12 sp. alpine Persia, Afghanistan.

**Dioon** Lindl. Cycadaceae. 2 sp. Mexico. The seeds are ground into meal, which contains much starch.

**Dioscorea** Plum. ex Linn. Dioscoreaceae. 150 sp. trop. and sub-trop. They have twining annual stems arising from tubers which in different sp. are of different morphological nature. In *D. Batatas* DCne., &c. the tuber arises by a lateral hypertrophy of the hypocotyl, and is variously regarded as a rhizome or a root; in *D. sinuata* Vel., &c. it arises by lateral hypertrophy of the internodes above the cotyledon; in *D. pentaphylla* L., &c. it arises from the internode just above the cotyledon together with the hypocotyl, whilst in *D. villosa* L., *D. quinqueloba* Thunb., &c., there is a fleshy rhizome. The tubers are known as yams; they contain much starch and are largely cultivated for food in tropical countries. They are propagated by cutting out the 'eyes' as in potatoes. Small axillary tubers often form on the main stem and may also be used for propagation.

**Dioscoreaceae.** Monocotyledons (Liliiflorae). 9 gen. with 170 sp. trop. and warm temp. Climbing herbs or shrubs with tubers or rhizomes at the base (the morphology of these is very varied; see chief genera). Leaves alt., net-veined, often arrow-shaped. Infl. racemose. Flrs. regular, usually dioecious, inconspicuous. P (6), tubular at base; A 6, or 3 and 3 staminodes;  $\bar{G}$  (3) usually 3-loc. with axile, rarely 1-loc. with parietal, placentae. Ovules usually 2 in each loc., anatropous, one above the other. Capsule or berry. Embryo in horny endosperm. The tubers of *Dioscorea* are valuable as food stuffs; those of *Testudinaria* are also used. *Chief genera:* *Dioscorea*, *Testudinaria*, *Tamus*. Placed in Epigynae by Benth.-Hooker, in Liliiflorae by Warming. [See Quéva, *Réch. sur l'anat. de l'app. végét.* d. *Taccacées et d. Dioscorées*, Lille. 1894.]

**Diosma** Linn. Rutaceae (IV). 11 sp. S. Afr. Heath-like xerophytes.

**Diospyrinae** (Warming). The 2nd cohort of Sympetalae (p. 146).

**Diospyros** Linn. Ebenaceae. 180 sp. trop. Many sp. yield the valuable wood ebony. The sapwood is white and soft, the heart-

wood hard and black. *D. reticulata* Willd. (Mauritius) and *D. Ebenum* Koen. (Ceylon) yield the finest ebony. *D. Embryopteris* Pers. is the gaub tree of India; its fruit contains a sticky pulp, used for caulking seams in boats. *D. Kaki* L. f. is the Chinese date plum, or persimmon, whose fruit is used as a sweetmeat when dried, *D. Lotus* L. (temp. As.) the common date-plum. *D. virginiana* L. (U.S.) is the N. Am. ebony or persimmon, cultivated for both wood and fruit.

**Diots** Desf. Compositae (VII). 1 sp. *D. candidissima* Desf. (*D. maritima* Sm.), the cotton-weed, on the coasts of Brit., W. Eur., and the Medit. A hairy perennial (p. 187).

**Dipcadi** Medic. Liliaceae (V). 12 sp. Afr., Medit., trop. As.

**Diphylla** Michx. Berberidaceae. 2 sp. N. Am., Japan.

**Diphyssa** Jacq. Leguminosae (III. 6). 10 sp. Mexico, Cent. Am.

**Diplachne** Beauv. Gramineae (X). 14 sp. trop. and sub-trop.

**Diplacus** Nutt. = *Mimulus* Linn.

**Dipladenia** A. DC. Apocynaceae (II. 4). 20 sp. S. Am. Most are lianes climbing by hooks—"a circle of blunt spines at the bases of the leaves."

**Diplarrhena** Labill. Iridaceae (II). 2 sp. S. Austr., Tasm.

**Diplopappus** Cass. = *Aster* Tourn.

**Diplotaxis** DC. Cruciferae (II. 10). 20 sp. Eur., Medit. (2 in Brit.).

**Diplusodon** Pohl. Lythraceae. 42 sp. Brazil.

**Dipsaceae**. Dicotyledons (Sympet. Aggregatae). About 150 sp. placed in 5 to 10 genera by different authors; chiefly N. temp., Old World. Most are herbs with opp. exstip. leaves (connate in *Dipsacus*), and cymes (*Triplostegia*, *Morina*) or heads of flowers. That the heads are also cymose (p. 53) is indicated by the fact that the fls. do not open in strictly centripetal order. The outer fls. have the corolla more or less drawn out on one side (cf. Compositae, Cruciferae &c.). Bracteoles of the ordinary kind are rare (*Triplostegia*). Most genera have an epicalyx, a cup-shaped organ springing from the base of the ovary, and usually regarded as composed of the two united bracteoles. K and C 5-merous, or 4-merous by union of two members. Sta. 4, epipetalous.  $\bar{G}$  (2), 1-loc. with one pendulous anatropous ovule. Fls. usually protandrous, of the floral class B' (p. 68). Fruit an achene (see Compositae) usually enclosed in the epicalyx. Seed with endosperm. Several are cultivated as ornamental plants; *Dipsacus* yields teasels. Chief genera: *Morina*, *Dipsacus*, *Scabiosa*. Placed in Asterales by Benth.-Hooker, in Dipsacales by Warming. (See *Sambucus* for relationships.)

**Dipsacales** (Warming). The 7th cohort of Sympetalae.

**Dipsacus** Linn. Dipsaceae. 12 sp. Medit., Eur., Afr. *D. sylvestris* Mill., the common teasel, in Brit. The connate leaves form troughs round the stem in which rain-water collects; it is very probable that some of this is absorbed by the plant. The protandrous fls. are

chiefly visited by bees. *D. fullonum* L. is the fuller's teasel. The bracts are hooked; the fruit-heads are largely used for raising the nap upon cloth.

**Dipteracanthus** Nees = *Ruellia* Linn.

**Dipterocarpaceae.** Dicotyledons (Archichl. Parietales). 16 gen. with 313 sp., Seychelles to New Guinea, chiefly in India. They are mostly trees with entire leathery stipulate leaves, and racemose infls. of ♂, regular, pentamerous flrs. Receptacle flat or slightly concave. K 5; C, 5 convolute; A 5, 10, 15 or more; G (3), 3-loc., with 2 ovules in each loc. Fruit usually a 1-seeded nut, enclosed in the calyx, some of whose leaves grow out into wings serving as an aid in wind-carriage of the seeds. No endosperm. All contain resin-passages. Many are very valuable as timber trees, and in other ways. *Chief genera:* *Dipterocarpus*, *Dryobalanops*, *Shorea*, *Vatica*, *Vateria*. Placed in Guttiferales by Benth.-Hooker, in Cistiflorae by Warming.

**Dipterocarpus** Gaertn. Dipterocarpaceae. 65 sp. India, Ceylon to Philipp. Is. The large amplexicaul stipules protect the young bud (cf. *Magnolia*, &c.). Several sp. yield wood-oil or Gurjun balsam, a resinous juice obtained by tapping the base of the trunk, and used as a varnish, &c. Many yield useful timber.

**Dipteryx** Schreb. (*Coumarouna* Aubl.). Leguminosae (III. 8). 8 sp. trop. Am. *D. odorata* Willd. furnishes the fragrant Tonka or Tonquin beans (the seeds) used in snuff, perfumery &c. The fruit is one-seeded and indehiscent.

**Disa** Berg. Orchidaceae (3). 60 sp. S. and trop. Afr. The median sepal is hood-shaped with a long spur at the back; the labellum is usually small. "In order that insects may reach the copiously stored nectar, they must insert their proboscides on either side of the column; and in accordance with this fact the viscid discs are turned outwards in an extraordinary manner. The pollinia are crooked, and when removed bend downwards by their own weight so that no movement is necessary" (Darwin).

**Dischidia** R. Br. (incl. *Conchophyllum* Blume). Asclepiadaceae (II. 4). 46 sp. Indo-mal., Polynes., Austr. Epiphytes (p. 184), climbing by adventitious roots, and with fleshy leaves which have a covering of wax. The most interesting sp. is the curious pitcher-plant, *D. Rafflesiana* Wall., which besides the ordinary leaves, has "pitcher-leaves." Each of these is a pitcher with incurved margin, about 10 cm. deep. Into the pitcher grows an adventitious root developed from the stem or petiole just beside it. The pitcher may hang with its mouth upwards or may stand horizontally or upside down. No final explanation of its meaning has yet been made. It usually contains a lot of debris, apparently largely carried into it by nesting ants. Most of the pitchers contain more or less rain water, so that very likely they act as humus collectors and water reservoirs for the plant. The inner surface is coated with wax, so that the water cannot be absorbed by

the pitcher itself, but must be taken up by the roots. It is also supposed that the pitchers are useful in condensing for re-absorption the vapour transpired by the numerous stomata upon their inner walls.

Developmental study shows the pitcher to be a leaf with its lower side invaginated. The existing sp. of *D.* illustrate all stages in the process. Many, e.g. *D. bengalensis* Colebr., have bi-convex leaves; others have the under surface concave, e.g. *D. (C.) Collyris* Wall., and the roots are developed under and sheltered by the concave leaves. From this stage a further invagination would lead to *D. Rafflesiana*. For further details of this interesting genus, see Treub in *Ann. Buitenz.* III. 1883, Haberlandt's *Tropenreise*, p. 168, and two papers in *Ann. of Bot.* 1893.

**Dischisma** Choisy. Scrophulariaceae (II. 9). 9 sp. S. Afr.

**Disciflorae** (Benth.-Hooker). The 2nd series of Polypetalae (p. 142).

**Disporum** Salisb. Liliaceae (VII). 12 sp. N. temp. As. and Am.

**Dissochaeta** Blume. Melastomaceae (I). 25 sp. Indo-mal., Philippines.

**Disteganthus** Lem. Bromeliaceae (I). 1 sp. Cayenne.

**Distichlis** Rafin. Gramineae (X). 4 sp. in salt places, Am. *D. maritima* Rafin. is also found in Austr. and is used for binding sandy soil (cf. *Ammophila*, *Carex*).

**Ditassa** R. Br. Asclepiadaceae (II). 60 sp. S. Am.

**Dodartia** (Tourn.) Linn. Scrophulariaceae (II. 8). 1 sp. S. Russia, W. As.

**Dodecatheon** Linn. Primulaceae (IV). 5 sp. N. Am., N.E. As. Like *Cyclamen*.

**Dodonaea** Linn. Sapindaceae (II). 46 sp. Austr., Sandw. Is., Madag.

**Dolichandrone** Fenzl. Bignoniaceae (II). 7 sp. Madag. to Malaya.

**Dolichos** Linn. Leguminosae (III. 10). 30 sp. trop. *D. Lablab* L. is largely cultivated in the tropics for its edible pods, which are cooked like kidney beans. *D. biflorus* L. the Horse-gram, is cultivated in India, &c. for feeding horses and cattle.

**Dombeya** Cav. Sterculiaceae. 40 sp. Afr.

**Dondia** Spreng. = *Hacquetia* Neck.

**Donia** G. et D. Don = *Clianthus* Soland.

**Doodia** R. Br. Polypodiaceae. 5 sp. Ceylon to Austr.

**Dorema** D. Don. Umbelliferae (7). 4 sp. W. Centr. As. *D. ammoniacum* D. Don is the source of the gum-ammoniacum used in medicine; it is obtained by puncturing the stem.

**Doronicum** Tourn. ex Linn. Compositae (VIII). 25 sp. N. temp. Two sp. are naturalised in parts of Britain.

**Dorstenia** Plum. ex Linn. Moraceae (I). 50 sp. trop. Am., Afr., 1 As., often grown in hot-houses. Herbs or shrubs with peculiar cymose infl. The common receptacle of the flrs. is a flat or hollowed fleshy structure, often more than an inch wide. The flrs. are unisexual, sometimes all of one sex on one receptacle, sometimes intermingled with several males round one female. They are sunk in the receptacle, round



whose edge project a number of bracts. The perianth-segments are completely united to one another. Sta. in the ♂ flr. usually 2. The fruit when ripe is shot out of the receptacle; the latter becomes very turgid and presses on the fruit and at length ejects it as one might fillip away a bit of soap between finger and thumb.

**Doryalis** = *Dovyalis* E. Mey.

**Doryanthes** Correa. Amaryllidaceae (II). 3 sp. Austr.

**Dorycnium** Linn. Leguminosae (III. 5). 10 sp. Medit.

**Douglasia** Lindl. Primulaceae (I). 3 sp. arctic N. Am., 1 Spain to Italy (alpine, see p. 157).

**Dovyalis** E. Mey. Flacourtiaceae. 3 sp. S. Afr., Madag. See *Aberia*. Placed in *Bixineae* by Benth.-Hooker.

**Downingia** Torr. (incl. *Clintonia* Dougl.). Campanulaceae (III.). 3 sp. Oregon, Calif., Chili. *D. pulchella* Torr. has no twisting of the floral axis, or not more than 90°.

**Draba** Dill. ex Linn. Cruciferae (IV. 14). 150 sp. N. temp. and arctic, and south-west. N. Am., 5 in Brit. (whitlow-grass). Most are tufted xerophytes with hairy or fleshy leaves.

**Dracaena** Vand. Liliaceae (VI). 40 sp. Old World trop. Mostly trees, whose stems branch and grow in thickness (by a peculiar 'extra-fascicular' cambium, see text-books of anatomy). The famous dragon-tree of Teneriffe (*D. Draco* L.), which was blown down in 1868, was 70 ft. high and 45 ft. in girth and was supposed to be 6000 years old. A resin exudes from the trunk of this sp., known as dragon's blood.

**Dracocephalum** Linn. Labiatae (VI. 3). About 40 sp. Eur., Medit., As., and 1 in N. Am.

**Dracontium** Linn. Araceae (IV). 6 sp. trop. Am. The sympodial rhizome gives rise yearly to one enormous leaf and an infl. The leaf has 3 chief divisions, and the lateral ones develop dichotomously at first. Flr. ♀ with perianth.

**Dracophyllum** Labill. (incl. *Sphenotoma* R. Br.). Epacridaceae. 26 sp. N. Z., Austr., New Caled. The sheathing leaves leave ring-scars when they fall.

**Dracunculus** (Tourn.) Adans. Araceae (VII). 2 sp. Medit. Fertilised like *Arum*.

**Drimia** Jacq. Liliaceae (V). 15 sp. Afr.

**Drimiopsis** Lindl. et Paxt. Liliaceae (V). 5 sp. S. and trop. Afr.

**Drimys** Forst. Magnoliaceae (3). 10 sp. S. Am., and N. Z. to Borneo. There is a distinction between calyx and corolla (cf. *Illicium*). The bark of *D. Winteri* Forst. (Winter's bark) is medicinal.

**Drosera** Linn. Droseraceae. 90 sp. trop. and temp. 3 in Brit. of which *D. rotundifolia* L., the sundew, is abundant in bogs. They are herbs usually with creeping rhizomes and rosettes of leaves. The blade of the leaf is circular in some sp., elongated in others, and is set with curious tentacles; these are emergences (p. 116) containing vascular bundles and ending in swollen reddish heads which secrete a sticky

fluid that glistens in the sun like dew. Flies and other insects mistaking it for honey are held by it. The tentacles are exceedingly sensitive to continued pressure even by the lightest bodies; the result is to cause an inward and downward movement of the head of the tentacle, finally placing the fly upon the blade of the leaf. At the same time the stimulus passes to the surrounding tentacles causing them also to bend downwards to the same point. The victim is thus smothered and now the glandular heads of the tentacles secrete a ferment which acts upon the proteids of the insect and brings them into solution, when they are taken up by the leaf. Afterwards the tentacles expand once more and recommence the secretion of the sticky fluid. It has been shown by direct experiment that the food thus obtained is of great benefit to the plant, though it can live without it. By this means *D.* is able to live in very poor soil where no other flowering plants can live. It is noteworthy that the extra materials thus obtained are devoted chiefly to seed-production. If the stimulus produced by the capture of an insect be very powerful, the leaf itself may bend into a cup form, and this feature is very marked in some sp., the leaves bending almost double over the prey. [See p. 195.]

The flrs. of the Brit. sp. rarely open, but pollinate themselves in the bud. The stigmas are branched each into two lobes.

**Droseraceae.** Dicotyledons (Archichl. Sarraceniales). 6 gen. with 100 sp. *Drosera* is a cosmopolitan genus, the rest are more local in distribution. Herbaceous plants, usually with perennial rhizome and rosettes of leaves. *Aldrovanda* is a water-plant. All are insectivorous plants; *Dionaea* and *Aldrovanda* have sensitive leaves which shut up when touched, the others catch their prey by means of sticky tentacles upon the leaves. For details see individual genera. Flrs. usually in cincinni, rarely in racemes or solitary, ♂, regular. 5—4-merous, usually hypogynous. K (5); C 5, imbricate or convolute; A usually 5, pollen in tetrads (cf. Ericaceae). Cpls. 2, 3 or 5, united; placentae usually parietal, rarely axile or free-central; style long; stigmas simple or branched. Ovules 3—∞, anatropous. Loculicidal capsule. Seed with endosperm and small basal embryo. *Genera*: *Dionaea*, *Aldrovanda*, *Drosophyllum*, *Drosera*, *Byblis*, *Roridula*. Placed in Rosales by Benth.-Hooker, in Cistiflorae by Warming.

**Drosophyllum** Link. Droseraceae. 1 sp., *D. lusitanicum* Link, Morocco, Portugal, S. Spain. The long narrow leaves are provided with glands of two kinds—stalked glands secreting a sticky fluid (cf. *Drosera*), and sessile ones which only secrete when stimulated by nitrogenous matter, and then secrete a digestive ferment. Insects alight on the glands and are entangled by the sticky secretion; they struggle for a while and finally sink down and die upon the leaf and are digested by the ferment. The taller glands have no power of movement, but are able to secrete a ferment as well as the sessile ones. [See p. 195 and *Bot. Cent.* 60, p. 33.]

**Drupaceae** (Warming) = Rosaceae (sub-order v).

**Dryandra** R. Br. Proteaceae (II). 50 sp. Austr. Like Banksia.

**Dryas** Linn. Rosaceae (III. 6). 2 sp. arctic. *D. octopetala* L. alpine in Brit. It is androdioecious in the Alps, but probably the ♂ plants are due to poor nourishment (p. 89). The style becomes feathery after fertilisation (cf. Clematis, Geum).

**Drymaria** Willd. Caryophyllaceae (II. 3). 30 sp. trop. and S. temp.

**Drymoglossum** Presl. Polypodiaceae. 3 sp. Himal. to Borneo. *D. carnosum* Hk. has succulent leaves.

**Drymonia** Mart. Gesneriaceae (I). 15 sp. trop. Am., W. Ind.

**Dryobalanops** Gaertn. f. Dipterocarpaceae. 4 sp. Borneo, Sumatra. *D. aromatica* Gaertn. and other sp. yield Borneo or Sumatra camphor; it is found in the cracks of the wood and is obtained by cutting up the trunk into pieces. It is rarely seen in Europe, being used chiefly in China, where it commands a high price. The young leaves are red, and hang downwards (p. 199).

**Duguetia** A. St. Hil. Anonaceae (3). 20 sp. trop. S. Am. *D. quitarensis* Benth. and other sp. furnish, it is said, some of the lancewood of commerce. The fruit is formed of the individual berries or achenes united to the fleshy receptacle.

**Duranta** Linn. Verbenaceae (II). 8 sp. S. Am.

**Durio** Adans. Bombacaceae. 7 sp. Indo-mal. *D. zibethinus* Murr. produces the durian fruit, well known for its delicate flavour and disagreeable smell.

**Duroia** Linn. f. Rubiaceae (I. 8). 10 sp. S. Am. The chief interest is the myrmecophilous habit (p. 117). *D. petolaris* Hk. f. and *D. hirsuta* K. Sch. have stems swollen just below the infl. The swollen part is hollow and entrance is obtained by two longitudinal slits. This curious organ seems to arise spontaneously and is inhabited by ants, which bite through the thin parenchymatous tissue of the slits. *D. sacculifera* Benth. et Hk. f., on the other hand, has its 'ant-houses' on the leaves. At the base, upon the under side of each leaf, are two pear-shaped organs formed by outgrowth of the leaf. The entrance is upon the upper side of the leaf, and protected from the rain by a little flap.

**Duvaua** Kunth = Schinus Linn.

**Dyckia** Schult. f. Bromeliaceae (3). 6 sp. Brazil.

**Dypsis** Noronha. Palmae (IV. 6). 6 sp. Madag. (p. 158).

**Dysodia** Cav. Compositae (VI). 34 sp. Am.

**Dysoxylum** Blume. Meliaceae. 100 sp. Indo-mal.

**Ebenaceae**. Dicotyledons (Sympet. Ebenales). 5 gen. with 280 sp. trop. (especially Indo-mal.). Trees and shrubs with alt., opp. or whorled, simple, leathery, usually entire leaves. Flrs. axillary, solitary or in small cymes, regular, usually dioecious, bracteolate, 3-7-merous. K persistent, gamosepalous; C convolute, gamopetalous. Sta. epipetalous at base of tube, usually in 2 whorls but frequently ∞ by branching; staminodes usually present in ♀ flrs., ovary syncarpous,

superior, 2—16-loc., with 1—2 anatropous ovules pendulous in each loc. Styles 2—8, free or united below. Fruit usually a berry with fewer seeds than there were formerly ovules, sometimes dehiscent. Embryo straight or slightly curved, in abundant cartilaginous endosperm. Many of these trees yield valuable wood, *e.g.* Diospyros. *Genera*: Royena, Euclea, Maba, Diospyros, Tetraclis. Placed in Ebenales by Benth.-Hooker, in Diospyrinae by Warming.

**Ebenales.** The 3rd cohort of Sympetalae in Engler's system, the 6th in Bentham and Hooker's system (pp. 140, 143).

**Ebenus** Linn. Leguminosae (III. 7). 14 sp. Medit.

**Echallium** A. Rich. Cucurbitaceae (III). 1 sp. Medit., *E. Elaterium* A. Rich., the squirting cucumber. When ripe the fruit is highly turgid. As it drops from the stalk, a hole is made in its lower end, and through this the contraction of the pericarp squirts the seeds, mixed with a watery fluid. A powerful purgative (elaterium) is prepared from the fruit.

**Eccremocarpus** Ruiz et Pav. Bignoniaceae (III). 3 sp. Peru. See order. The valves of the fruit hang together at the top.

**Echeveria** DC. = Cotyledon Linn.

**Echidnopsis** Hook. f. Asclepiadaceae (II. 4). 4 sp. E. Afr. Xerophytes with succulent stems.

**Echinocactus** Link et Otto. Cactaceae (I. 1). 200 sp. Texas to Chili. Ribbed cacti (see order).

**Echinocereus** Engelm. = Cereus Haw.

**Echinocystis** Torr. et Gray. Cucurbitaceae (IV). 25 sp. Am. Tuberous climbing herbs. *E. lobata* Torr. et Gray is often cultivated. Its tendrils are very sensitive and nutate very rapidly. The tendril becomes straight and erect as it comes round towards the main axis, thus avoiding contact.

**Echinophora** Tourn. ex Linn. Umbelliferae (4). 8 sp. Medit. One cpl. is aborted. The umbel has one ♀ flr. in the centre, surrounded by 3 flrs. The spiny stalks of the latter enclose the fruit.

**Echinops** Linn. Compositae (XI). 75 sp. E. Eur., Afr., As. The spherical head is really compound, formed of a great number of small 1-flowered heads, each with its own involucre. The flrs. are largely visited by bees.

**Echinopsis** Zucc. = Cereus Haw.

**Echinopterys** A. Juss. Malpighiaceae (1, but forming a link between 1 and 2, as it has a flat torus). 1 sp. Mexico. Mericarp spiny.

**Echinospermum** Sw. Boraginaceae (IV. 2). 50 sp. temp. *E. Lappula* Lehm. is often cultivated. The flrs. change colour from white to red and blue (see order). Fruit hooked.

**Echites** P. Br. Apocynaceae (II. 4). 40 sp. Am.

**Echium** Tourn. ex Linn. Boraginaceae (IV. 5). 30 sp. Eur., Medit. *E. vulgare* L., viper's bugloss, in Brit. Flr. zygomorphic, protandrous, visited by bees.

**Edwardsia** Salisb. = *Sophora* Linn.

**Ehretia** Linn. Boraginaceae (11). 40 sp. trop., chiefly Old World. Trees and shrubs.

**Ehrharta** Thunb. Gramineae (VII). 20 sp. S. Afr., 2 Mascar., 2 N. Z. Useful pasture grasses for sandy soil.

**Eichhornia** Kunth. Pontederiaceae. 5 sp. S. Am. The sympodium is very complex (see *Nat. Pfl.*). Each shoot in turn is pushed to one side by the axillary shoot of its last leaf but one; with this shoot it is combined, however, up to the first leaf of the axillary shoot. After leaving the axillary shoot, each shoot bears another leaf, and then ends in the infl., which is enclosed in a spathe, and which at first glance appears to spring from the stalk of the last leaf. In *E. azurea* Kunth. the flrs. are dimorphic, in *E. crassipes* Solms trimorphic heterostyled. This last sp. has, when floating freely in water, large bladder-like swollen petioles, but if it be grown in soil, these are not nearly so large. Their object is not clearly understood, but they cause the plant to float high in the water and it is easily blown about by wind.

**Elaeagnaceae**. Dicotyledons (Archichl. Thymelaeales). 3 gen. with 17 sp. found chiefly on steppes and coasts of the N. Hemisph. They are much branched shrubs, often with leathery leaves, which are entire, opp. or alt., and covered, as are all parts of the plants, with scaly hairs. There are frequently thorns on the surface (reduced shoots). Infl. racemose. Flrs. ♂ or unisexual, 2- or 4-merous. In the ♂ the receptacle is often flat, but in the ♀ or ♂ flower it is tubular as in Thymelaeaceae, and may be fused with the ovary. No petals. Sta. as many, or twice as many as sepals. Cpl. 1 with one erect anatropous ovule. Fruit a pseudo-drupe. Seed with little or no endosperm. *Chief genera*. Hippophae, Elaeagnus. Placed in Daphnales by Benth.-Hooker, in Thymelaeinae by Warming.

**Elaeagnus** (Tourn.) Linn. Elaeagnaceae. 12 sp. As., Eur., N. Am. (the oleaster). The fruit of some sp. is edible, and the plants are grown in shrubberies.

**Elaeis** Jacq. Palmae (IV. 7). 2 sp., one in trop. Am., the other, *E. guineensis* Jacq. in trop. Afr. The latter is the oil-palm, from whose fruits the palm-oil, so largely used for railway axles &c., is obtained by boiling.

**Elaeocarpaceae**. Dicotyledons (Archichl. Malvales). 7 gen. with 120 sp. trop. and sub-trop. Trees and shrubs with alt. or opp., stipulate leaves, and racemes, panicles or dichasia of flrs. Disc usually present. K 4 or 5, free or united, valvate; C 4 or 5, rarely united, the petals often much divided at the ends, valvate or imbricate but never convolute. Flr. often apetalous. Sta. ∞, free, on the disc, which is sometimes developed to an androphore; anthers 2-loc., usually opening by two pores (sometimes confluent) at the apex. Ovary sessile, with 2—∞ (rarely 1) loc. Ovules in each loc. ∞ or 2, anatropous, pendu-

lous with ventral raphe. Style simple, sometimes lobed at apex. Fruit a capsule or drupe. Embryo straight, in abundant endosperm. *Chief genera*: Elaeocarpus, Sloanea, Aristotelia. The E. are united to Tiliaceae by Benth.-Hooker and Warming; the grounds upon which they are separated in *Nat. Pfl.* are chiefly anatomical.

**Elaeocarpus** Burm. ex Linn. Elaeocarpaceae. 60 sp. trop.

**Elaeodendron** Jacq. f. Celastraceae. 30 sp. As., Austr., S. Afr., trop. Am. Included in Cassine in *Nat. Pfl.*

**Elaterium** Jacq. f. Cucurbitaceae (1v). 12 sp. trop. Am. The fruit is explosive like that of *Ecballium*.

**Elatinaceae**. Dicotyledons (Archichl. Parietales). 2 gen. with 30 sp. trop. and temp. Undershrubs, herbs, or annual water-plants; the latter are able to live on land, altering their structure to suit the changed conditions (see p. 173 and cf. *Littorella* &c.). Leaves opp. or whorled, simple with interpetiolar stipules. Flrs. ♂, regular, solitary or in dichasia, 2—6-merous. Calyx hypog., free or united. Corolla imbricate. Sta. in 2 whorls, or inner aborted. Ovary syncarpous, superior, multiloc., with simple style. Placentae axile. Ovules ∞, anatropous. Capsule septifragal. Seed straight or curved. Endosperm thin or none. *Genera*: *Bergia*, *Elatine*. Placed in *Guttiferales* by Benth.-Hooker, in *Cistiflorae* by Warming.

**Elatine** Linn. Elatinaceae. 14 sp. trop. and temp. *E. hexandra* DC. and *E. Hydropiper* L., the water peppers or pipe-worts, in Brit. (rare).

**Elatineae** (Benth.-Hooker) = Elatinaceae.

**Elatostema** Forst. Urticaceae. 50 sp. Indo-mal. and E. As.

**Eleocharis** R. Br. Cyperaceae (1). 80 sp. cosmop. *E. palustris* R. Br. is common on turfy moors in Brit. The green tissue is centric (p. 192). The tubers of *E. tuberosa* Schult. (E. As.) are used as food.

**Elephantopus** Linn. Compositae (1). 16 sp. trop. Am., W. Afr.

**Elettaria** Maton. Zingiberaceae. 1 sp. India to Java, *E. Cardamomum* Maton. The flrs. are borne on leafless shoots springing from the rhizome. The dried fruits are known as Cardamoms, and are used as a condiment.

**Eleusine** Gaertn. Gramineae (x1). 6 sp. trop. and sub-trop. *E. coracana* Gaertn. is used as a cereal, and several are useful fodder-grasses.

**Elisma** Buchen. Alismaceae. 1 sp. Eur. (incl. Brit.), Syria, *E. natans* Buchen.

**Ellisia** Linn. Hydrophyllaceae. 4 sp. N. Am.

**Elodea** Michx. Hydrocharitaceae. 6 sp. Am., of which the chief is *E. canadensis* Michx., the American water-weed, which arrived in Brit. about 1842 and rapidly spread over almost all the inland waters of western Europe. Only the ♀ plant is known in Europe, and all the spreading is therefore due to vegetative multiplication chiefly by the breaking off of twigs. It is a submerged plant, slightly rooted, with whorls of leaves, in whose axils are found the squamulae usual in

this group of plants. The ♂ flower has P 6, A 9; it breaks off as a bud and comes to the surface (cf. *Vallisneria*), where it opens. The ovary of the ♀ flr. grows to such a length as to bring the flr. to the surface, where it is pollinated. It has P 6, staminodes 3, G (3), and is enclosed below in a 2-leaved spathe. The plant is very hardy and does not form a true winter bud; the leaves are merely a little more closely grouped together.

**Elymus** Linn. Gramineae (XII). 30 sp. temp. *E. arenarius* L., the lyme grass, occurs on sand-dunes in Brit. (cf. *Ammophila* and see p. 188); its leaves are coated with wax, but do not roll up in dry air.

**Embellia** Burm. f. Myrsinaceae (II). 60 sp. trop.

**Embothrium** Forst. Proteaceae (II). 5 sp. Andes, Chili, E. Austr.

**Emex** Neck. Polygonaceae (I. 2). 1 sp. Medit., S. Afr., Austr. The fruit is surrounded by the perianth, 3 of whose leaves are spiny.

**Empetraceae**. Dicotyledons (Archichl. Sapindales). 3 gen. with 4 sp., widely scattered over the N. Hemisph. and in the Andes. They occupy similar positions to the Ericaceae, and have a heath-like habit. The leaves are incurved backwards, forming a cavity on the under side, into which the stomata open, and which is partly filled up by hairs. The infl. is racemose and usually dioecious. In all but *Corema* the flrs. are on 'short shoots' which arise laterally from the main axis and bear only scales below the infl. K 3, C 3, A 3, G (2—9). Loculi = cpls.; ovules 1 in each, anatropous or nearly campylotropous, erect on axile placenta, with ventral raphe. Fruit a drupe with 2—9 stones. Seed albuminous with no caruncle. The nearest related orders are Euphorbiaceae and Celastraceae or Buxaceae, but the family has been placed in various positions by different authors, e.g. by Benth.-Hooker (p. 145). *Genera*: *Corema*, *Empetrum*, *Ceratiola*.

**Empetrum** (Tourn.) Linn. Empetraceae. The only sp., *E. nigrum* L. the crow-berry, is found on moors in the N. temp. zone (incl. Brit.) and in the Andine chain. For habit, flr., &c., see order. The flr. is dioecious and anemophilous, but it sometimes is ♂ and protandrous, and is said to be visited by flies.

**Enantioblastae** (Warming). The 4th cohort of Monocotyledons.

**Encephalartos** Lehm. Cycadaceae. 12 sp. Afr. The Kaffirs prepare a meal from the pith (cf. *Cycas*).

**Entada** Adans. Leguminosae (I. 5). 11 sp. trop. *E. scandens* Benth. is a common climber of trop. Am. Its pods, which are about 4 feet long, are sometimes carried to Eur. by the Gulf Stream.

**Entellia** R. Br. Tiliaceae. 1 sp. N. Z. (p. 158). The wood is very light, and is used for floats, &c.

**Epacridaceae**. Dicotyledons (Sympet. Ericales). 21 gen. with about 320 sp., found chiefly in Austr. and Tasmania, where they represent the Ericaceae of other continents, but extending also to India, N. Z., and S. Am. They resemble the Ericaceae (sect. IV.) closely in habit and appearance, being mostly small shrubs, sparingly branched, with

narrow, entire, rigid leaves, usually alternate. Sometimes the leaves are sheathing, in which cases either no scar is left on the stem when the leaf falls, or a ring mark is left, as in *Dracophyllum*. The flrs. are usually in terminal racemes or spikes, ♂, actinomorphic. K 5, C (5). A 5, hypogynous at edge of disc, or more often epipetalous; the anthers opening by one central longitudinal slit and without horns or other appendages; pollen simple or in tetrads.  $\bar{G}$  (5) cpls. opposite petals, placentae axile; ovules in each loc.  $1-\infty$ , anatropous, usually pendulous. Style simple, sometimes in depression of top of ovary, with a capitate stigma. Fruit a capsule or stony drupe. Embryo straight, in copious endosperm. *Chief genera*: *Sprengelia*, *Richea*, *Dracophyllum*, *Epacris*, *Styphelia*. Placed in *Ericales* by Benth.-Hooker, in *Bicornes* by Warming.

**Epacrideae** (Benth.-Hooker) = *Epacridaceae*.

**Epacris** Forst. *Epacridaceae*. 30 sp. S.E. Austr., N.Z., New Caled. They are much cultivated in greenhouses for their flrs.

**Ephedra** Tourn. ex Linn. *Gnetaceae*. 20 sp. warm temp. Shrubs, much branched, with opp. connate leaves reduced to scales, so that the stem performs the work of assimilation (p. 181). Flrs. declinous, with no trace of cpls. in ♂, or of sta. in ♀. ♂ flrs. in spikes, the ♀ in pairs or solitary, usually bracteate. The ♂ flr. has a perianth of 2 antero-posterior united leaves, beyond which the axis is prolonged and bears 2—8 sessile 2-locular anthers. The ♀ has a tubular perianth and one erect orthotropous ovule with a long micropyle projecting at the top of the flr.; the flr. or flrs. are enclosed by bracts which become red and fleshy after fertilisation and enclose the fruit. The seed is enclosed in the perianth, which becomes woody, and the fleshy bracts cover this again. There are two cotyledons in the embryo; the seed is albuminous. For further details see *Nat. Pfl.*, and art. *Gymnospermae*.

**Epidendrum** Linn. *Orchidaceae* (13). Over 400 sp. trop. Am., many epiphytic. The labellum is often more or less united to the column, and a canal runs from the junction right down into the ovary.

**Epigaea** Linn. *Ericaceae* (11. 4). 2 sp., *E. asiatica* Maxim. in Japan, *E. repens* L., the trailing arbutus or mayflower, in the atlantic U.S. (p. 156). The flrs. are tetramorphic (Darwin, *Forms of Flrs.* p. 297).

**Epigynae** (Benth.-Hooker). The 2nd series of *Monocotyledons*.

**Epilobium** Dill. ex Linn. *Onagraceae* (11). 160 sp. temp. and arctic; 9 in Brit. (willow-herbs). The flr. is regular, but in some sp. slightly zygomorphic by the bending of sta. and style (p. 69), which project so as to make a landing-place for insects. Of the Brit. sp. several may be noticed, as the flrs. form an interesting series in regard to cross-pollination, &c. (cf. *Phacelia*, *Geranium*, &c.). In *E. angustifolium* L. the flrs. are large and autogamy almost impossible. Honey is secreted by the upper surface of the ovary. The sta. are ripe when the flr. opens, and project horizontally, whilst the style, with its



stigmas closed, is bent downwards. Afterwards the sta. bend down and the style up, and the stigmas open. This is the plant in which C. K. Sprengel (1793, see biography in *Nat. Science*, 1893) made the first discovery of dichogamy. In *E. hirsutum* L. sta. and stigma are ripe together, but the stigma projects beyond the sta.; if not pollinated it bends back and touches the anthers. *E. parviflorum* Schreb. is a small-flowered sp., rarely visited by insects; 4 sta. are shorter, 4 longer, than the style; the former are only useful for cross-pollination, the latter self-pollinate the flr. Sta. and stigma ripen simultaneously. The seed of *E.* is provided with a tuft of hairs for wind-carriage.

**Epimedium** (Tourn.) Linn. (excl. *Vancouveria* C. Morr. et Dcne.). Berberidaceae. 10 sp. N. temp. Old World. *E. alpinum* L. is naturalised in Brit. It has, like most *E.*, a 2-merous flr., which is pendulous, with glandular hairs on the stalk. It is protogynous, and after a time the valves of the anthers bend upwards and roof over the stigma, and the male stage begins. Finally self-pollination occurs by the elongation of the style carrying the stigma among the valves. The nectaries are of a curious shoe-like pattern. The seeds have a membranous aril.

**Epipactis** Adans. Orchidaceae (4). 10 sp. N. temp.; 2 in Brit., *E. latifolia* All., and *E. palustris* Crantz (helleborine). There are two staminodes at the sides of the column; the anther is acrotonic. The labellum has a hinged terminal portion, which by its rebound causes the insect to fly somewhat upwards in leaving the flr. In so doing it rubs the rostellum, which instantly becomes very viscid and cements the pollinia (which have no true caudicles) to the insect. The chief visitors are wasps (p. 103). See Darwin's *Orchids*, p. 93.

**Epiphyllum** Haw. Cactaceae (1. 1). 4 sp. Brazil, often epiphytic.

**Epipogon** S. G. Gmel. Orchidaceae (4). 1 sp. Eur. (incl. Brit.), As., *E. aphyllum* Sw., a leafless saprophyte (p. 195) with a branched rhizome and no roots; it has an endotropic mycorrhiza (p. 23) Flr. as in *Epipactis*, but without any twisting of the receptacle.

**Epipremnum** Schott. Araceae (11). 8 sp. Indo-mal.

**Episcia** Mart. Gesneriaceae (1). 30 sp. trop. Am.

**Equisetaceae**. Pteridophyta (Equisetinées). An order with only one surviving genus (*Equisetum*, *q.v.*), but formerly well represented upon the earth. Many large fossil forms (*Calamites*, &c.) are known.

**Equisetineae**. One of the main divisions of Pteridophyta (*q.v.*), containing the single order Equisetaceae.

**Equisetum** Linn. Equisetaceae (the only genus). 25 sp. temp. and arctic; 9 in Brit. (horsetails), chiefly in swampy places. They are perennial herbs with sympodial rhizomes, which send up aerial shoots each year. These may be of one or two kinds; in some sp. the ordinary green shoot bears the reproductive spike at the end, while in others there is a special reproductive shoot, usually appearing early

in the year, and often without chlorophyll, the ordinary shoots performing assimilating work only. The stem is very distinctly jointed, and at the nodes are borne whorls of united leaves, closely pressed against the stem, and of little or no use in assimilation. The branches emerge through the leaf-sheath and thus appear at first sight endogenous in origin (p. 22); in reality they are exogenous, but formed so much later than the leaves that their points of origin are already covered by the leaf-sheath, and so they are compelled to burrow through it. Stages in this process may easily be observed. The surface of the stem is grooved; the ridges are occupied by mechanical tissue, whilst the green tissue and stomata are at the base of the furrows. This is a marked xerophytic structure (p. 181) and is repeated very closely in *Casuarina*. In several sp. the internodes of the rhizome are swollen into tubers, which serve for hibernation and vegetative propagation.

The spike is very like the ♂ flr. of a Conifer, and has as much right to the title of flower. It consists of an axis with short internodes, bearing a densely packed mass of sporophylls. Each is shield-shaped and bears a number of sporangia upon the under side of the head (*i.e.* towards the stem), arranged like the horses of a 'merry-go-round.' The spores are of one kind only; each has, running round it, two spiral cuticularised bands of membrane, formed from the outer wall and termed *elaters*. These are hygroscopic, unfolding in damp air. In the rolling up again on drying, the elaters of one spore become entangled with those of others and cause them to adhere together, so that several prothalli may be formed near to one another when they germinate upon the soil. This is very necessary, for the prothalli are dioecious, though so far as we can tell the spores are all alike. The prothallus is fairly large, the male being smaller than the female.

The stems of *E. hyemale* L. are used for polishing under the name of Dutch rushes; the cell-walls of the mechanical tissues contain much silica, as do also those of most sp.

For further detail, see Pteridophyta, and Campbell's *Mosses and Ferns*.

**Eragrostis** Host. Gramineae (x). 100 sp. mostly subtrop.

**Eranthemum** Linn. (excl. *Pseudcranthemum* Radlkf.). Acanthaceae (iv. A). 17 sp. trop. As.

**Eranthis** Salisb. Ranunculaceae (2). 7 sp. N. temp. *E. hyemalis* Salisb., the winter aconite, is naturalised in Brit. It has a thick rhizome or row of tubers, one formed each year. The flrs. appear in February, before the leaves, and are solitary and terminal. Each has an involucre of three green leaves, a 'calyx' of 6 segments, and several honey-leaves or petals.

**Eremia** D. Don. Ericaceae (iv. 10). 30 sp. Cape Col.

**Eremurus** Bieb. Liliaceae (III). 20 sp. alpine, W. and Cent. As. The

flr. is protogynous; the petals crumple up before the essential organs are ripe. The leaves of *E. aurantiacus* Baker are eaten in Afghanistan.

**Erica** Lindl. Orchidaceae (21). 80 sp. trop. As. Epiphytes.

**Eriachne** R Br. Gramineae (18). 22 sp. trop. As, Austr.

**Erianthus** Michx. Gramineae (11). 17 sp. trop

**Erica** (Tourn.) Linn. Ericaceae (IV 9). 420 sp. Eur. (esp. Medit.) and S. Afr. (see order). 5 sp. occur in Brit. The two common heaths, *E. cinerea* L. and *E. Tetralix* L., cover great areas of moor; the others are rarities of Cornwall and Ireland. In habit *E.* resembles *Calluna*. The flr. is bell-shaped and pendulous, visited and fertilised mainly by bees. Honey is secreted by the disc, and insects hanging on to the flr. and probing for it, must shake the sta. and receive a shower of the loose powdery pollen from the pores in the tips of the anthers. In the wider mouthed sp the anthers have horn-like projections at the back, which ensure contact with the insect's proboscis. The stigma projects beyond the sta so as to be touched first.

Many S Afr. sp. are cultivated in greenhouses. *I. scoparia* L. is the common heath of S. France &c, growing several feet high. It is known as Bruyere and its rootstocks furnish 'briar' wood pipes. The roots of heaths possess an endotropic mycorrhiza

**Ericaceae.** Dicotyledons (Sympet Fricales) A family of about 50 gen. and 1350 sp. Owing to their numbers and their social habit of growth the *E.* form very characteristic parts of the vegetation in many portions of the globe. They are found in most parts of the world except in deserts and in hot damp tropical regions. The *Ericoideae* are confined to Africa, Medit and Europe, the two great masses of them being however separated by the Sahara, though sp. of *Erica* &c. occur in each. Another peculiar phenomenon is that those sp. of *Andromedeae* with north circumpolar distribution (e.g. *Andromeda polifolia*) have their nearest allies in trop. and sub-trop. floras (see Drude in *Nat. Pfl.* or *Pflanzengeog.* for a full discussion of the interesting distribution of *E.* See also the genera, esp. *Rhododendron*, *Vaccinium*, *Calluna*, *Erica*)

The distribution of *E.* on arctic moors and swamps and on dry moors in warmer regions (almost all of them grow in peaty soil) would lead us to expect the presence of xerophytic characters in them; and such is indeed the case, especially in *Ericoideae*. The family consists of woody plants varying in size from small undershrubs to large shrubs or even trees. Two types of habit may be distinguished—that of *Ericoideae* and that of the remaining tribes. In the latter there are usually true winter-buds formed (e.g. *Rhododendron*), even though the leaves may last over the winter. The bud is covered with scale leaves, and when its elongation occurs these drop off and a gap is left on the stem; the foliage leaves tend to form rosettes at the ends of the twigs. The leaves themselves are generally elliptical, entire or nearly

so, and leathery, frequently hairy. The upper epidermis is stoutly cuticularised, and there is very often water storage tissue between it and the green tissue. In the *Ericoideae* there are no true winter-buds or scale-leaves; the plants are evergreen, and the whorled leaves needle-like, often through being rolled back on themselves to form a groove or even a chamber on the under side (cf. *Empetrum*, and see p. 192).

The infl. commonly terminates a strongly growing shoot, and a sympodial growth tends to be formed. The flrs. may be solitary, but are more often in racemose groupings, each with a bract and two bracteoles, 8, actinomorphic or slightly zygomorphic. K 4—5; C (4—5) or 4—5 (*Ledaeae*), usually bell-shaped; A 8—10, obdiplostemonous, hypogynous or rarely slightly epipetalous; anthers introrse, often with projecting appendages, the thecae often spreading at top, and opening by apical pores; pollen grains in tetrads. Below the gynæceum is a fleshy disc secreting honey. G (4—5) superior or inferior, 4—5-locular, with axile placentae; ovules in each loc. 1—∞, anatropous; style simple with capitate stigma. Fruit a capsule, drupe or berry. Embryo cylindrical, in copious endosperm.

The flrs. of the Brit. sp. are mostly bee-flrs. with a 'loose-pollen' mechanism. The hanging position and the size of the flower are suited to bees. The stigma projects so as to be first touched, and in probing for the honey at the base of the flr. the bee touches the sta. or their projecting horns, and by thus shaking them causes a shower of pollen to fall upon itself from the tips of the anthers. *Calluna* is partly anemophilous; *Kalmia* has a curious explosive mechanism (see C., K., and *Erica*, &c.).

Bentham and Hooker separate *Vaccinioideae* from the E. and make of them an independent order, on account chiefly of the inferior ovary. They add to the E. as here defined, the *Pyrola* group of *Pyrolaceae* (q.v.).

*Classification and chief genera* (after Drude).

I. *RHODODENDROIDEAE* (septicidal capsule; seed with ribbed loose coat, often winged; corolla falling after flowering; sta. with upright or long adnate anthers, with no appendages):

1. *Ledaeae* (polypet.): *Ledum*.
2. *Rhododendreae* (zygomorphic): *Rhododendron*, *Menziesia*.
3. *Phyllodoceae* (actinomorphic): *Loiseleuria*, *Kalmia*, *Phyllodoce*, *Daboecia*.

II. *ARBUTOIDEAE* (berry or loculicidal capsule; seed triangular or ovate, not winged; corolla falling; anthers much folded, with peg-like appendages, or prolonged into tubes, shedding the pollen upwards; ovary superior):

4. *Andromedaeae* (dry capsule with small calyx at base): *Cassiope*, *Andromeda*, *Epigaea*.

5. *Gaultherieae* (fruit a capsule or berry; calyx fleshy round capsule, or leafy; anthers blunt at tip or with two short processes): *Gaultheria*, *Pernettya*.
- 6. *Arbutae* (calyx as small disc at base of berry; anthers with two long processes): *Arbutus*, *Arctostaphylos*.
- III. *VACCINIOIDEAE* (as II., but ovary inferior):
  7. *Vaccinieae* (ovary sharply defined from peduncle): *Gaylussacia*, *Vaccinium*.
  8. *Thibaudieae* (calyx decurrent on ovary and going over into peduncle): *Pentapterygium*, *Agapetes*, *Paphia*, *Macleania*, *Thibaudia*.
- IV. *ERICOIDEAE* (fruit usually a loculicidal capsule or a nut; seeds round, not winged; corolla persistent after flowering; anther with short connective, thecae spreading above, frequently appendaged):
  9. *Ericae* (> 1 seed in each loc.): *Calluna*, *Erica*.
  10. *Salaxideae* (1 seed in each loc., capsule or nut): *Eremia*, *Salaxis*.

[The E. belong to the cohort termed Ericales by Benth.-Hooker and Engler, Bicornes by Warming.]

**Ericales.** The 1st cohort (Engler) of Sympetalae (p. 139). The 4th cohort (Benth.-Hooker) of Gamopetalae (p. 143).

**Erigeron** Linn. Compositae (I.1). 150 sp. cosmop., chiefly N. Am.; 2 in Brit. (flea-bane).

**Erinus** Linn. Scrophulariaceae (III. 10). 1 sp. Pyrenees, Alps (p. 159).

**Eriobotrya** Lindl. Rosaceae (II. 4). 10 sp. sub-trop. As. The fruit of *E. japonica* Lindl. is a favourite dessert fruit in the East (loquat).

**Eriocaulaceae.** Monocotyledons (Farinosae). 6 gen. with 340 sp. mostly trop. and sub-trop. (see Eriocaulon). Perennial herbs with grass-like leaves. Flrs. in heads (involucrate), inconspicuous, unisexual, 2- or 3-merous, regular or zygomorphic. Perianth usually sepaloid, in 2 whorls. ♂ flr. with 4 or 6 sta. (3 or 2 in *Paepalanthus*); anthers di- or mono-thecous. ♀ flr. with superior ovary of (2-3) cpls., with one orthotropous pendulous ovule in each loc. Fruit a capsule. Endosperm. Chief genera: *Eriocaulon*, *Paepalanthus*. [Placed in *Enantioblastae* by Warming, in *Glumaceae* by Benth.-Hooker.]

**Eriocaulaeae** (Benth.-Hooker) = preceding.

**Eriocaulon** Linn. Eriocaulaceae 110 sp. trop. and sub-trop. *E. septangulare* With. occurs in the eastern U.S. and also in the Scottish Hebrides and the west coast of Ireland (the only representative of the order in Eur.).

**Eriocephalus** Linn. Compositae (VII). 19 sp. S. W. Afr.

**Eriochloa** H. B. et K. Gramineae (v). 5 sp. trop. and sub-trop. Fodder-grasses.

**Eriodendron** DC. (*Ceiba* Medic. q.v.). Bombacaceae. 9 sp. trop., chiefly Am. *E. anfractuosum* DC., the silk-cotton tree, has its seeds

enveloped in silky hairs, which are used for stuffing cushions, &c. [See Kingsley's *Westward Ho*, c. XXI.]

**Eriogonum** Michx. Polygonaceae (I. 1). 120 sp. N. Am., chiefly western U.S. The genus differs much from most of the order, having no ocreae, and having cymose umbels or heads of flrs. The partial infl. consists of a few or many flrs. surrounded by a special involucre formed of united bracts. The partial infls. are combined in various ways into heads &c.

**Eriolaena** DC. Sterculiaceae. 8 sp. E. Ind.

**Eriophorum** Linn. Cyperaceae (1). 12 sp. N. temp. chiefly on turf moors (p. 191). 4 sp. in Brit. (cotton-grass or cotton-sedge). The ♂ flrs. are massed together; each has a perianth of bristles which after fertilisation grow out into long hairs surrounding the fruit and acting as a means of distribution. The hairs are sometimes used in stuffing pillows &c.

**Eriophyllum** Lag. Compositae (VI). 12 sp. N. W. Am.

**Eriosema** DC. Leguminosae (III. 10). 70 sp. trop. and sub-trop.

**Eriospermum** Jacq. Liliaceae (III). 25 sp. chiefly Cape Colony.

**Eriostemon** Sm. Rutaceae (III). 16 sp. Austr., New Caled.

**Eritrichium** Schrad. (incl. *Cryptantha* Lehm.). Boraginaceae (IV. 2). 90 sp. temp.

**Erodium** L'Hérit. Geraniaceae. 50 sp. temp. (2 in Brit.—Stork's-bill). Like Geranium. The awn twists into a corkscrew-form with a free end and is very hygroscopic. The mericarp has a sharp point with backward pointing hairs. It falls on the ground, frequently point downwards, and the free end of the awn catches against surrounding objects. If dampness supervene, the awn untwists and so lengthens: the free end being entangled, the fruit is driven into the soil. When dry the awn once more curls up, and the process may be repeated (cf. *Stipa*).

**Erophila** DC. Cruciferae (IV. 14). 4 sp. Eur., Medit. (1 Brit. *E. vulgaris* DC.). Included in *Draba* in *Nat. Pfl.*

**Eruca** Tourn. ex Adans. Cruciferae (II. 10). 10 sp. Medit. Oil is obtained from the seed of *E. sativa* Mill.

**Erucastrum** Presl = *Brassica* Tourn.

**Ervum** Tourn. ex Linn. = *Vicia* Tourn. For *E. Lens* L. see *Lens*.

**Eryngium** (Tourn.) Linn. Umbelliferae (3). About 150 sp. trop. and temp. (exc. S. Afr.). 2 sp. in Brit. (*Eryngo* or sea-holly) on the sea-shores. They are prickly herbs with thick roots and fleshy leaves coated with wax (p. 187). Flrs. in cymose heads, blue and largely visited by bees. Fibre (*Caraguata* fibre) is obtained from the leaves of *E. pandanifolium* Cham. et Schlecht.

**Erysimum** (Tourn.) Linn. Cruciferae (IV. 16). 80 sp. Medit., Eur., As. (*E. cheiranthoides* L., treacle mustard, in Brit.)

**Erythraea** Renealm. Gentianaceae (I. 2). 30 sp. temp. *E. Centaurium* Pers., the common centaurry, occurs in Brit. in many varieties.

**Erythrina** Linn. Leguminosae (III. 10). 30 sp. trop. and subtrop.

*E. crista-galli* L. is a favourite in cultivation. Its bright red flrs. are inverted; the wings are nearly aborted; the keel forms at its base a honey sac. Probably humming-birds are the visitors. *E. indica* Lam. is largely planted as a shade for coffee and other plants, and as a support for pepper. *E. caffra* Thunb., the Kaffir-boom, furnishes a very light timber.

**Erythrochiton** Nees et Mart. Rutaceae (v). 5 sp. trop. Am. The infl. springs from the surface of a leaf, owing to adnation (p. 54).

**Erythronium** Linn. Liliaceae (v). 7 sp. N. temp.

**Erythrophleum** Afzel. Leguminosae (II. 1). 5 sp. Afr., China, N. Austr. *E. guineense* G. Don is the red-water tree of Sierra Leone. "The bark is a powerful poison and is used by the native tribes as an ordeal. A red juice flows from the tree, which is used for the same purpose."

**Erythroxylaceae**. Dicotyledons (Archichl. Geraniales). 2 gen. with 90 sp. trop. Nearly allied to Linaceae, in which they are placed by Benth.-Hooker. Flr. regular,  $\bar{g}$ ; K 5, C 5, A 5 + 5 united at base, G (3 or 4), usually 1-loc. Ovules 1 or 2, pendulous. Drupe. Endosperm. Chief genus: Erythroxylon.

**Erythroxylum** P. Br. Erythroxylaceae. 90 sp. trop. and subtrop., chiefly Am. *E. Coca* Lam. (Peru), the coca, is the chief sp. The leaves are infused like tea or chewed with lime and enable the person using them to undergo great fatigue. Cocaine, used as a local anaesthetic, is prepared from them. Many sp. have heterostyled flrs.

**Escallonia** Mutis. Saxifragaceae (v). 50 sp. S. Amer., chiefly Andine. Shrubs with alternate, leathery, gland-dotted leaves. Ovary inferior, 2—3-loc., with twice as many placentae and  $\infty$  ovules.

**Escalloniaceae** (Warming). An order of Saxifraginae, included in Saxifragaceae by other authors.

**Eschscholzia** Cham. Papaveraceae (2). 10 sp. western U.S., often cultivated as border flowers. The receptacle is concave, so that the flr. is perigynous. In dull weather each petal rolls up on itself, enclosing and protecting some of the sta. The ripe fruit explodes and scatters the seeds; each valve as it dries has a tendency to roll up spirally, and thus a great tension is set up (p. 112).

**Esenbeckia** H. B. et K. Rutaceae (2). 10 sp. trop. Am., W. Ind.

**Espeletia** Mutis. Compositae (v). 11 sp. Andes. Characteristic plants of the alpine region (Paramo). Aloe-like xerophytes with dense covering of hairs (see Goebel, *Pflanzenbiol. Schild.*).

**Eucalyptus** L'Hérit. Myrtaceae (2). 140 sp. Austr., 2 or 3 Indo-mal. One of the most characteristic genera of the Austr. flora (blue-gum, iron-bark, stringy bark, blood-wood, &c.). Some sp. reach an enormous size, e.g. *E. amygdalina* Labill. which has been found 450 ft. high and 90 ft. in girth. The leaves at first formed are opposite and dorsiventral, the later ones alternate and isobilateral, and thus more

suited to the climate. The floral receptacle is hollow and becomes woody in the fruit. The calyx is thrown off as a lid when the fr. opens.

On account of their rapid growth and economic value, these trees are now largely cultivated in India, Algeria, &c. Many sp. yield valuable timber; *E. Globulus* Labill. (blue-gum) yields oil of eucalyptus; others yield oils, kino, &c.

**Eucharis** Planch. et Linden. Amaryllidaceae (I). 6 sp. Columbia. The sta. spring from the margin of the corona (see order).

**Euchlaena** Schrad. Gramineae (I). 1 sp. Mex., *E. mexicana* Schrad. Very like Zea in habit and infl. The ♀ spikelets are free from one another and do not form a 'cob.' It is used as a cereal in Cent. Am.

**Eucnide** Zucc. = *Mentzelia* Linn.

**Eucomis** L'Hérit. Liliaceae (v). 5 sp. S. Afr. The dense spike of flrs. is crowned by a tuft of bracts.

**Eucryphiaceae**. Dicotyledons (Archichl. Parietales). 1 gen., *Eucryphia*, with 4 sp. S. Am., Austr. Placed in Rosaceae, near to *Quillaja*, by Benth.-Hooker. See *Nat. Pf.*

**Eugenia** Mich. ex Linn. (incl. *Jambosa* DC., *Syzygium* Gaertn.). Myrtaceae (I). 625 sp. trop. Many sp. have edible fruit, e.g. *E. malaccensis* L., the rose-apple or Malay apple. The dried flr.-buds of *E. caryophyllata* Thunb. form the well-known spice cloves.

**Eulophia** R. Br. Orchidaceae (16). 50 sp. trop.

**Eunomia** DC. = *Aethionema* R. Br.

**Euonymus** Linn. Celastraceae. 60 sp. N. temp., and S.E. As. *E. europaeus* L., the spindle-tree, in Brit. Several sp. have curious outgrowths of cork upon their stems. The flrs. are polygamous and protandrous. On the ripe seed is a bright red fleshy aril, serving in bird-dispersal. The development of the aril may easily be studied by examining seeds of various ages. The wood is used for spindles, pegs, &c., and furnishes good charcoal.

**Eupatorium** (Tourn.) Linn. (incl. *Conoclinium* DC.). Compositae (II). 400 sp. mostly Am., a few in Eur., As., trop. Afr. *E. cannabinum* L., hemp-agrimony, in Brit. Its flrs. are largely visited by butterflies.

**Euphorbia** Linn. Euphorbiaceae (A. II. 8). 600 sp. chiefly sub-trop. and warm temp. (12 in Brit.). They differ very much in vegetative habit. The British sp. of spurge are herbs and so are many others, but shrubs are also frequent. The chief interest centres in those sp. that inhabit very dry places and have consequently a xerophytic habit. Most of these forms closely resemble Cactaceae (q.v.), and sometimes when not in flr. it is very difficult to decide from the outside appearance whether one has to do with a *Euphorbia* or a Cactus. The presence of latex of course distinguishes the former. It is very interesting to see how similar conditions of life have called forth, in three different orders not nearly allied to one another, such a similarity of habit as is seen in *Euphorbia*, the Cactaceae, and



Stapelia (Asclepiadaceae). As in the cacti, we get almost spherical forms, ridged forms, cylindrical forms, &c. Many are armed with thorns. In all cases it is the stem which is fleshy. The outer tissue is green and does the assimilating work of the plant; the inner portion of the stem consists mainly of parenchymatous storage tissue.

The best accessible account of the morphology of *E.* is that of Goebel (*Pflanzenbiol. Schild.* p. 56), from which the following is abstracted. He divides the plants roughly into the following groups:

I. Leaves normal, well developed, serving a long time as assimilative organs. (1) Shoot not water-storing: e.g. the British sp. (2) Storage in tubers below ground: *E. tuberosa* L. (3) Stem as reserve for water, &c., but not green: *E. bupleurifolia* Jacq. (cylindrical stem covered with corky scales=leaf bases. Leaves borne in wet season, drop off in dry). (4) Stem fleshy, green, leafy in wet season only: *E. nervifolia* L., &c.

II. Leaves abortive, dropping off early. Assimilation and storage carried on in stem. Various types occur here (cf. Cactaceae) approaching more or less nearly to a perfectly spherical form. Some common ones are (1) *E. Tirucalli* L. (Zanzibar), with thin cylindrical shoots. *E. pendula* Link is very similar and closely resembles *Rhipsalis* in the Cactaceae. (2) *E. xylophyllodes* Brougn. has flattened shoots (cf. *Phyllanthus* § *Xylophylla*, and *Epiphyllum* in Cactaceae). (3) *E. Caput-Medusae* L. has a stout stock giving off a number of thinner branches at the top. These are covered with little cushion-like papillae, closely crowded, which are really leaf bases; the leaf proper is undeveloped. Many sp. show this structure. (4) *E. mammillaris* L. has a thorn in the axil of each cushion (=a metamorphosed infl.-axis). If the cushions, as in the cacti, become 'fused,' we get a ridged stem, as is seen in (5) *E. polygona* Haw (cf. *Echinopsis cereumformis* in Cactaceae), *E. grandicornis* and many others. Most of these sp. exhibit pairs of stout thorns which are the stipules of the abortive leaves. By the two horizontal thorns one can tell one of these plants from a cactus, which has a group of thorns. (6) *E. meloformis* Ait. is nearly spherical but ribbed, whilst in (7) *E. globosa* Sims (cf. *Echinocactus*) we have an almost perfect sphere. [The student should read at the same time the art. Cactaceae, and Stapelia, and compare all these succulent forms with one another. See also Goebel, *loc. cit.*]

Besides the above, mention may be made of *E. splendens* Boj. and *E. Boyeri* Hook., plants with thick stems and green leaves, the latter being dropped in the dry season.

The other chief point of interest in *E.* is the *cyathium*, or infl. condensed to simulate a single flr. The resemblance is almost perfect. The general branching of the plant is cymose (dichasial). The partial infl. forms a *cyathium* by the non-development of its internodes, the absence of the perianths of the individual flrs. and the reduction of each ♂ flr. to one sta. There is a perianth-like organ of 5 leaves,

really bracts, and between these are 4 curious horn-like bodies (U-shaped in fig.), which are the combined stipules of the bracts. Then follow a number of sta. arranged with the oldest nearest to the centre and each with a peculiar joint half-way up the stalk. In the middle of the cyathium is a 3-carpelled ovary on a long stalk. This is usually ripe for pollination before any of the sta. ripen.

That this cyathium is an infl. and not a flr., consisting of a lot of  $\sigma$  flrs., each of 1 sta., round a single  $\text{f}$  flr., is shown by several facts, e.g. the centrifugal (cymose) order of ripening of the organs, and the joint on the sta.; at this point in the allied genus *Anthostema*, there is a perianth, which shows that the sta. is really a reduced  $\sigma$  flr.



Diagram of central cyathium of infl. of *Euphorbia Peplus* L. (after Eichler, modified).

In *E. § Poinsettia* the infl. is rendered conspicuous by the bright red colour of the larger upper bracts. These sp. are often cultivated as showy conservatory plants.

The fruit explodes when ripe; the carpels split off from the central axis and open at the same moment.

**Euphorbiaceae.** Dicotyledons (Archichl. Geraniales). 220 gen. with 4000 sp., cosmop., except in the arctic regions. Few sp. have a very wide range; the most widely-ranging genus is *Euphorbia* itself. Benth.-Hooker place *E.* in Incompletae, but it is closely related to Geraniales by the structure of the gynœceum, &c., although separated a good deal from the other orders of the cohort by the amount of reduction that has occurred in most of its flrs.

Most *E.* are shrubs or trees, a few herbaceous (e.g. the Brit. sp.). Many are xerophytes; a number of Australian sp. are of ericoid habit (p. 181); the S. Afr. sp. of *Euphorbia* are cactus-like; others resemble Lauraceae, or possess phylloclades (e.g. *Phyllanthus* sp.). A few are lianes. The leaves are usually alternate; some have opposite leaves, some opposite leaves above and alternate below. Stipules are usually present, but may be represented by branched hair-like bodies (jatrophæ), glands, or thorns. Nearly all *E.* contain latex in special laticiferous cells.

The infl. is usually complex; almost every type occurs. Often the first branching is racemose and all subsequent ones cymose. In some cases, e.g. *Dalechampia* and *Euphorbia (p.p.)*, the partial infls. are so condensed as to give the appearance of single flrs. The flrs. are always unisexual, monœcious or diœcious, regular, hypogynous. The perianth may be present as two whorls; more often there is only one (calyx) and frequently the flr. is naked. The perianth is usually 5-merous. Sta. 1— $\infty$ , free or united in various ways. *Ricinus* has

branched sta. *Phyllanthus cyclanthera* has the sta. united, with a ring-like common anther. G usually (3), with axile placentae, and 3 loc. Styles usually 2-lobed. The ovules are constant throughout the family and form its best distinctive feature; they are 1 or 2 in each loc., collateral, pendulous, anatropous, with ventral raphe. The micropyle is usually covered by a caruncle, which is also found on the seed. The fruit is almost invariably a 'schizocarp-capsule.' It splits into cpls. often elastically, and at the same time each cpl. opens ventrally, letting the seed escape. Seed albuminous.

Most E. are poisonous. Several are important economic plants, e.g. Manihot (rubber, cassava), Hevea (rubber), Croton, Ricinus, &c. *Classification and chief genera* (after Pax):

A. PLATYLOBEAE (cotyledons much broader than radicle):

I. PHYLLANTHOIDEAE (ovules 2 per loc.; no latex):

1. *Phyllanthaceae* (embryo large, little shorter than endosperm;  $\delta$  calyx imbricate): *Phyllanthus*.
2. *Brideliaceae* (do., but  $\delta$  calyx valvate): *Bridelia*.
3. *Daphniphyllaceae* (embryo short, 4--6 times shorter than endosperm): *Daphniphyllum*.

II. CROTONOIDEAE (ovules 1 per loc.; latex usually present):

1. *Crotonaceae* (sta. bent inwards in bud): *Croton*.
2. *Acalyphaceae* (sta. erect in bud; flr. usually apetalous;  $\delta$  calyx valvate; infl. a raceme, spike, or panicle, axillary or terminal): *Mercurialis*, *Acalypha*, *Ricinus*, *Dalechampia*.
3. *Jatrophaeae* (do.; infl. a dichasial panicle): *Hevea*, *Jatropha*.
4. *Manihoteae* (do.; infl. a simple terminal spike or raceme): *Manihot*.
5. *Cluytiaceae* ( $\delta$  calyx imbricate;  $\delta$  flrs. with petals, in groups or cymes, these partial infls. axillary or in complex infls.): *Codiaeum*.
6. *Geloniaceae* (do. but apetalous): *Gelonium*.
7. *Hippomaneae* (do.; apetalous; infl. axillary or terminal, spike-like, the partial infls. cymes): *Stillingia*, *Hura*.
8. *Euphorbiaceae* (cyathium): *Anthostema*, *Euphorbia*.

B. STENOLOBEAE (cotyledons as wide as radicle):

I. PORANTHEROIDEAE (ovules 2 per loc.): *Poranthera*.

II. RICINOCARPOIDEAE (ovules 1 per loc.): *Ricinocarpus*.

[E. are placed in Unisexuales by Benth.-Hooker, in Tricoccae by Warming.]

**Euphrasia** Linn. Scrophulariaceae (III. 12). 50 sp. extra-trop. *E. officinalis* L. (eyebright) is common in Brit. Semi-parasites with loose-pollen flrs. (see order). The 4 anthers lie close under the upper lip of the flr.; the two upper cohere together and also the upper on each side to the lower on the same side; the lower lobe of each anther has a projecting spine. Insects probing for honey shake these spines and receive upon their heads a shower of pollen from among the

anthers. The stigma protrudes beyond the sta. in most flrs. so as to be touched first, but every stage can be found from highly protogynous flrs. with very protruding stigmas to almost homogamous flrs. whose stigma does not protrude and where self-fertilisation is the rule.

**Eurya** Thunb. Theaceae. 36 sp. Mexico, S. Am., W. and E. Ind.

**Euryale** Salisb. Nymphaeaceae (III). 1 sp. S. E. As. Flr. epigynous. The seeds and roots are eaten in China.

**Eurybia** Cass. = *Olearia* Moench.

**Eurycles** Salisb. Amaryllidaceae (I). 2 sp. N. Austr., Malaya.

**Eusporangiateae**. See Filicineae.

**Euterpe** Gaertn. Palmae (IV. 6). 10 sp. trop. Am. *E. edulis* Mart., the Assai palm, yields an edible fruit; a nutritious beverage is prepared from it by soaking the fruit in water.

**Eutoca** R. Br. = *Phacelia* Juss.

**Evodia** Forst. Rutaceae (I). 45 sp. trop., exc. Am.

**Evolvulus** Linn. Convolvulaceae (I. 2). 80 sp. trop. and sub-trop.

**Exacum** Linn. Gentianaceae (I. 1). 30 sp. Old World trop. The style is bent to one side or other of the flr.; both arrangements occur on the same plant (see p. 73).

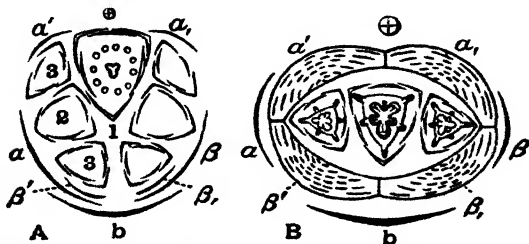
**Excoccaria** Linn. Euphorbiaceae (A. II. 7). 30 sp. trop., exc. Am. For *E. sebifera* Muell.-Arg. see *Sapium*.

**Exogonium** Choisy = *Ipomoea* Linn.

**Faba** (Tourn.) Linn. = *Vicia* Linn.

**Fadyenia** Hook. Polypodiaceae. 1 sp. *F. prolifera* Hook., W. Ind. The sterile leaves produce buds at the tips.

**Fagaceae**. Dicotyledons (Archichl. Fagales). 5 gen. with 350 sp.; there are three chief centres of distribution—*Fagus*, *Castanea* § *Eucastanea* and *Quercus* in N. extra-trop. regions, *Pasania* and *Castanopsis* in trop. As. and Calif., *Fagus* § *Nothofagus* in S. Am., N. Z.,



Floral diagrams of *Castanea vulgaris*, after Eichler. A, diagram of ♂ cyme in axil of catkin-leaf, the sta. and rudimentary gynoecium only shown in the first flr. The sequence of the flrs is indicated by the figures 1, 2, 3. B, diagram of ♀ partial infl. b = bract, a = bracteoles, a' = bracteoles of second order.

and S. Austr. Most are trees with simple leaves and scaly stipules that drop off as the leaves expand. The flrs. come out in the axils

of the leaves of the current year and are diclinous and anemophilous. They are arranged in catkins or small spikes (exc. *Fagus* ♂). In general there is a close resemblance to Betulaceae, and, as in that order, the flrs. are usually in dichasial cymes in the axils of the catkin-leaves; there are often, however, more than three flrs.

Perianth bract-like, (4—7). ♂ flr. with as many to twice as many or  $\infty$  sta. undivided, with or without rudimentary style. ♀ flrs. usually in dichasia of 3 in *Castanea*, 2 in *Fagus*, 1 in *Quercus* &c.  $\bar{G}$  usually (3) with 3 styles (exc. sp. of *Castanea*); loculi 3, usually visible before fertilisation. Placentae axile, each bearing 2 pendulous anatropous ovules with 2 integuments. Fruit a 1-seeded nut. Seeds without endosperm.

The group of nuts is surrounded by a cup-like organ termed a *cupule*; in the oak there is one nut in each cupule, in the beech two, in the chestnut three. About the morphology of this organ there has been much discussion. Eichler (see diagram above, fig. B, and *Blüthendiagr.*) regards it as the combined bracteoles  $\alpha'$   $\beta'$   $\alpha$ ,  $\beta$ , Prantl (Engler's *Bot. Jahrb.* VIII. 1887) as an axial outgrowth. See also Celakovsky in *Pringsheim's Jahrb.* XXI. 1890, and cf. Betulaceae. The cupule only becomes clearly visible after fertilisation.

Some of the F. show signs of peculiar development of the embryo-sac, and other interesting features (see Chalazogamæ).

The order includes several important economic plants, chiefly valuable for their timber, e.g. oak (*Quercus*), beech (*Fagus*), chestnut (*Castanea*), &c.

*Classification and genera* (after Prantl):

1. *Fageae* (flrs. in dichasia, rarely solitary in axils of foliage-leaves; lateral and single fruits 3-angled): *Fagus* (incl. *Nothofagus*).
2. *Castaneae* (♀ flrs. in dichasia or single in the axils of catkin-leaves; fruit rounded at sides): *Castanea*, *Pasania*, *Quercus*.

[Benth.-Hooker unite F. with Betulaceae, as Cupuliferae, placing them in Unisexuales; Warming places them in Querciflorae.]

**Fagara** Linn. = *Zanthoxylum* Linn.

**Fagopyrum** Tourn. ex Hall. Polygonaceae (II. 4). 2 sp. As. The flrs. resemble those of *Polygonum*, but are heterostyled, with long and short-styled forms (p. 88). *F. esculentum* Moench is the buckwheat, largely cultivated, especially in N. Am., for its fruit (seed), in which there is a floury endosperm. The plant is also used as green fodder, and is a good honey-plant.

**Fagraea** Thunb. Loganiaceae. 20 sp. E. Ind. to Austr., often epiphytic. Some sp. have nectaries at the outside of the base of the flr. These attract ants which are said to prevent bees from boring holes in the flr. to rob the honey (p. 99).

**Fagus** (Tourn.) Linn. (incl. *Nothofagus* Blume). Fagaceae (1). The genus forms 2 sections, § *Eufagus* with 4 sp. N. temp. and § *Nothofagus*

with 12 sp. antarctic S. Am., N. Z. and S. Austr. *F. sylvatica* L., the beech, is found in Brit. and over large parts of Eur. It often forms homogeneous forests, and is accompanied by a peculiar undergrowth, e.g. *Asperula odorata*, *Lathraea squamaria*, &c. (see Höck in *Bot. Centr.* 52, p. 353, 1892). The ♂ flrs. are in pendulous cymose heads, the ♀ in pairs; each cupule encloses two nuts. The wood of the beech is hard, and is much used in the arts; an oil is expressed from the nuts. It forms hedges in many districts; when growing low it does not drop its leaves, as it does when it takes the tree form, and thus a beech-hedge affords good shelter in winter for gardens &c. A variety with red sap in the cells of the epidermis is often cultivated in parks under the name copper-beech. The beech only flowers every few years, and saves up material in the interval (cf. Agave). *F. (N.) Cunninghamii* Hook., the myrtle-tree (Austr.) is an evergreen sp. largely cultivated in Austr. &c.

**Falcaria** Riv. ex Rupp. Umbelliferae (5). 1 sp. Eur., As.

**Falkia** Linn. f. Convolvulaceae (1. 1). 4 sp. Afr.

**Faradaya** F. Muell. Verbenaceae (IV. 4). 5 sp. Austr., Polynes.

**Faramea** Aubl. Rubiaceae (II. 18). 100 sp. trop. S. Am., W. Ind.

See Muller's *Fert. of Flrs.* p. 304 (dimorphic pollen).

**Farinosae** (Engler). The 7th cohort of Monocotyledons (p. 135).

**Farsetia** Turra (incl. *Fibigia* Medic.). Cruciferae (IV. 18). 19 sp. Medit.

**Fatsia** Dcne. et Planch. (incl. *Echinopanax* Dcne. et Planch., and *Tetrapanax* C. Koch). Araliaceae. 3 sp. Japan, N. W. Am. *F. papyrifera* Benth. et Hook. f. is the rice-paper tree of Japan. The paper is made from the pith, which is split into thin sheets and pressed (cf. *Cyperus*).

**Fedia** Gaertn. Valerianaceae. 1 sp. Medit., *F. Cornucopiae* Gaertn. For other sp. see *Valerianella*.

**Feronia** Correa. Rutaceae (X). 1 sp. India to Java, *F. elephantum* Correa, the Elephant-apple or Wood-apple. The wood is useful, and the tree yields a gum, used instead of gum-arabic. The fruit is edible.

**Ferula** Tourn. ex Linn. Umbelliferae (7). 80 sp. Medit., Cent. As. *F. communis* L. is often cultivated in shrubberies under the name of giant-fennel. It only flowers after storing up materials for some years (cf. *Fagus*, *Agave*). *F. Narthex* Boiss. and *F. Assa-foetida* Linn. are the sources of the drug Asafoetida, obtained by notching the roots and collecting the escaping juice. It is used as a condiment in Persia &c. under the name 'food of the gods,' and as a stimulant in medicine. *F. galbaniflua* Boiss. et Buhse and *F. rubricaulis* Boiss. are the sources of the gum galbanum, used in medicine.

**Festuca** (Tourn.) Linn. Gramineae (X). 90 sp. cosmop.; 5 in Brit. (fescue-grass). The leaves roll up inwards in dry air like those of *Stipa*. Many are good pasture-grasses. The sp. when growing on mountains are commonly viviparous (see order).

**Feuillea** Gled. = *Fevillea* Linn.

**Fevillea** Linn. Cucurbitaceae (1). 6 sp. trop. Am. The 5 sta. are all alike.

**Fibigia** Medic. = *Farsetia* Turra.

**Picaria** (Dill.) Hall = *Ranunculus* Linn.

**Ficoideales** (Benth.-Hooker). The 14th cohort of Polypetalae (p. 143).

**Ficoideae** (Benth.-Hooker) = *Aizoaceae*.

**Ficus** Tourn. ex Linn. Moraceae (11). 600 sp. trop., chiefly in E. Ind. and Polynes., &c. A very important genus of trees and shrubs of the most various habit. In general they possess alternate entire leaves, with stipules which envelope the bud (acting as a protection to it against heat, &c.) and soon after their unfolding drop off altogether. Adventitious roots are very common. The simplest way, perhaps, of dealing with the great variety of form will be to consider one by one some of the commonest sp.

*F. elastica* Roxb., the indiarubber tree, usually grows as a stout independent tree, but sometimes epiphytically like *F. benjamina*, reaching often very considerable dimensions. At its base (see figs. in *Nat. Pfl.*) are developed buttress-roots, radiating out in all directions; their depth is often several feet, while their thickness is only a few inches. From the branches are given off adventitious roots which grow downwards, enter the soil, branch out, and suck up nourishment. These grow in thickness and form great pillars supporting the branches. The leaves are entire, and leathery in texture, with a glossy surface which refuses to be wetted; their apex is not provided with a 'drip-tip' (see *F. religiosa*, below). The stipules protect the bud. Caoutchouc is obtained from the latex by cutting notches in the tree bark after it is at least 25 years old.

*F. indica* L. and *F. benghalensis* L. show similar habit. The latter is the famous banyan tree. Its aerial roots form supporting pillars, and, if allowed to establish them freely, the tree may reach immense size, covering a great area. (It is sacred in India, and the roots are provided with tubes of bamboo to protect them, and the ground is prepared for them.) See plate in *Nat. Pfl.*

*F. religiosa* L. (the Peepul or Bo-tree) is similar, but its leaves have a long acuminate apex, combined with an easily wetted surface. From the apex the rain drips off rapidly after a shower and the leaf is soon dry. In the very wet tropical forests of E. India, &c., this property is of some importance to the plant (see Stahl, *Regenfall und Blattgestalt*, *Ann. Buitenz.* 1893, or abstract by Miss Lorrain Smith in *Nat. Science*, 1893).

*F. Sycomorus* L., the true sycamore or mulberry fig, and *F. Carica* L. the fig, are also erect trees.

*F. repens* Rottl. is a small climbing sp. which takes hold of its support by aerial roots (as in ivy); these secrete a gummy substance containing caoutchouc, and then absorb the fluid constituents, leaving

the caoutchouc as a cement, fastening the roots to their support (Darwin, *Climbing Plants*, p. 185).

*F. Thwaitesii* Mig. and other climbing sp. are heterophyllous, the leaves on the climbing shoots being small and of different shape to those on the erect shoots.

*F. Benjaminia* L. and other sp. climb up other trees giving off aerial clasping (negatively heliotropic) roots which surround the trunk of the support. These roots thicken and unite into a network and finally often strangle the 'host' altogether. These sp. often become epiphytic by the dying away of their lower portions, but, like the Aroids they maintain their communication with the ground by long aerial roots. Sometimes they commence as epiphytes and send down aerial roots to the soil.

The infl. is hollowed out, and consists of a number of flrs. inside a pear-shaped common receptacle, which opens by a narrow mouth at the top. Within the mouth, in most sp., are the  $\sigma$  flrs., while the rest of the cavity is filled with  $\varphi$  flrs. (see Sachs, *Physiol.* p. 434, and figs. in *Nat. Pfl.*). The  $\sigma$  has a perianth and 1 or 2 sta., the  $\varphi$  a smaller perianth. The infl. as a whole is protogynous. The mode of pollination is very extraordinary (cf. *Yucca*), there being a special insect (*Blastophaga*, a small wasp) adapted to *Ficus* flrs. The gravid female enters a fig infl. and lays eggs in the ovaries; the male wasps thus formed fertilise the females and these as they emerge are pollinated by the  $\sigma$  flrs. and carry the pollen to new figs. For further details and an account of the peculiar process of 'caprification,' see Muller's *Fert. of Flrs.* p. 521, *Nat. Pfl.*, Cunningham on *F. Roxburghii* (rev. in *Bot. Centr.* 45, p. 344), and papers in *Bot. Jahrb.* 11. 1890, p. 245.

Many sp. bear the flrs. on old parts of the stem (p. 35). The fruit is a multiple fruit, composed of a lot of drupes inside the common fleshy receptacle; that of *F. Carica* L. is the common fig.

Lac (shellac, &c.) is produced on several sp. by the punctures of a small hemipterous insect (cf. *Butea*). Several sp. yield caoutchouc, obtained by notching the stems. The buttress-roots are used as planks by the natives.

**Filago** Linn. Compositae (IV). 12 sp. Eur., As., Am., N. Afr.; 3 in Brit.

**Filices.** The Ferns proper or Homosporous Leptosporangiate Filicineae (see below).

**Filicineae.** One of the main divisions of Pteridophyta. They are characterised by well-developed leaves, with vigorous growth, often of large size and much branched. The stem is usually short in proportion to the leaf area, and is not much branched. The sporangia are borne on the leaves and are usually very numerous.

#### Classification:

A. **EUSPORANGIATAE** (sporangium derived from a group



of superficial cells; homosporous; stem simple; sporangia usually sunk in tissue of sporophyll, or in synangia on its surface).

N. O. 1. Ophioglossaceae. 2. Marattiaceae.

B. *LEPTOSPORANGIATAE* (sporangium derived from single superficial cell).

a. Homosporous (*Filices*):

N. O. 1. Osmundaceae. 2. Gleicheniaceae.

3. Hymenophyllaceae. 4. Schizaeaceae.

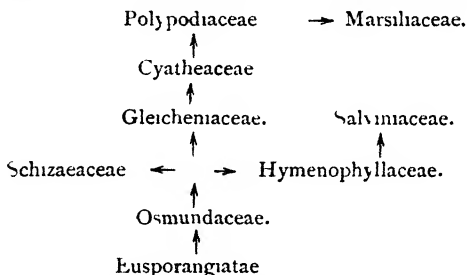
5. Cyatheaceae. 6. Polypodiaceae.

b. Heterosporous (*Hydropterideae*).

N. O. 1. Marsiliaceae. 2. Salviniaceae.

For further details see the next two articles, and the various natural orders

The relationships of these orders are much disputed. Campbell (*Mosses and Ferns*, p. 421) proposes the following genealogical tree:



See Campbell, *loc. cit* and Pteridophyta, Spermatophyta, &c.

**Filicineae Eusporangiatae.** The two families (Ophioglossaceae and Marattiaceae) which form this section differ much in detail, but agree in the mode of formation of the sporangia from a group of epidermal cells. Formerly they were usually classed as a higher and more specialised group of ferns than the Leptosporangiatae, but it is now generally agreed that they are really the older group (see Campbell, *Mosses and Ferns*, p. 295 and p. 516).

The exact relationships of these plants to one another and to the other members of the vegetable kingdom are extremely difficult to discover, for we have to deal with a few surviving branches of a stock whose maximum period of development occurred ages ago, and these branches are widely separated in character both from each other and from other groups of plants. (See Filicineae for genealogical tree.)

The prothallus is but little known, it probably is always green at first, but in the O. becomes subterranean later in life. It lives for a long time even after the new sporophyte is established. The antheridia are sunk in the tissue of the prothallus. The two orders show

great differences in the habit and structure of the sporophyte. The stem grows but little in length, and does not usually branch; it is closely covered by the bases of the leaves. Upon these the sporangia are borne. In the M. they are formed on the under side of ordinary foliage leaves, but in the O. the leaf divides some way above the base into a ventral spike bearing sporangia, and a dorsal 'sterile' portion or green blade. The sporangia also differ in the two orders (*q.v.*). Both are homosporous.

*Classification:*

Order 1. *Ophioglossaceae*: sporangia on special spike, borne on ventral side of leaf.

2. *Marattiaceae*: sporangia on ordinary foliage leaves, usually combined into synangia.

To these various authors, *e.g.* Campbell (*loc. cit.*), add the *Isoetaceae* as a heterosporous group. In this work they are treated as belonging to Lycopodiaceae, but their systematic position is exceedingly doubtful.

**Filicineae Leptosporangiatae.** [See above for relationship to other F.]

We shall deal with the two groups separately.

1. *Homosporous F. L.* These plants are generally known as Ferns; only a few of the other groups of F. come in popular estimation under this title. An outline of the general life history will be found under Pteridophyta, but a few details must be added here.

The fertilised ovum on the prothallus develops directly and without any resting period into a fern-plant. There is no intermediate period of rest as there is in flowering plants when the seed is ripe. The prothallus continues to assimilate food and supply the young fern until the latter is able to do so for itself. The primary root remains small or withers away, and new ones are adventitiously formed from the stem or from the leaf bases, as the plant continues to grow. The mature plant may be of almost any size from the tiny filmy ferns (*Hymenophyllum*) to the large tree ferns (*e.g.* *Cyathea*, *Alsophila*). The stem grows by an apical cell, 2- or 3-sided, cutting off segments on each face alternately. From these segments by further divisions arise the tissues and members of the plant. The leaves form a little way behind the growing apex as in flowering plants. One segment (but not every one) gives one leaf: the leaf grows by an apical cell also. The stem may be erect, or may climb (as in many epiphytes), or creep on the surface, or below it as a rhizome. Its growth is slow and branching infrequent. The leaves are borne upon it, the internodes being as a rule short in erect, long in creeping stems. The phyllotaxy is not so definite as in flowering plants, but the leaves are very commonly in ranks or straight lines dependent on the position of the segments cut off from the apical cell of the stem. The lateral buds arise either on the leaf (as in *Nephrodium*) or on the stem; in the latter case they are rarely axillary, but usually beside the leaf.

The growing tips of stem and leaf are often protected by brown scales, which are mere trichomes or superficial outgrowths.

The leaf is usually large, with apical growth and circinate (coiled) vernation. The growth often lasts for a long time, or even permanently (*Lygodium*). The leaf blade is usually branched pinnately.

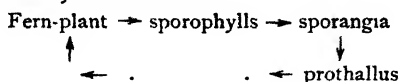
The reproductive organs are borne upon the leaves. The unit is the sporangium or spore capsule, a small rounded body, stalked in orders 5 and 6 (below) but sessile in the others. The capsule has a wall one cell thick, and in this is a group of cells with peculiarly thickened cell walls, termed the *annulus*, by whose agency (its cells being hygroscopic) the opening of the sporangium is effected. Sometimes, as in many Polypodiaceæ, the opening is explosive, and the contained spores are violently ejected. The mechanism is in principle similar to that by which anthers dehisce or certain seed capsules open. The annulus may have various forms (see the orders, below) but the commonest is that of a row of cells running round the sporangium for about  $\frac{3}{4}$  of its circumference.

The sporangia are usually collected into groups termed *sori*. The 'sorus' may be naked, but is more usually covered by an *indusium*. In some cases, *e.g.* *Pteris*, this is merely a fold of the leaf itself, but more commonly it is a special outgrowth from the leaf, either epidermal or derived from the more deeply placed layers of tissue as well. The sori are usually found on the veins of a leaf, often in the angle where a vein forks. They do not as a rule occur on all the leaves. Very often certain leaves are fertile, the others not. In this case the fertile leaves have usually no green tissue at all, their pinnae being entirely covered with sori, *e.g.* *Osmunda* sp. In other cases, *e.g.* *Aneimia* sp., one part of a leaf is sterile, the other fertile. Or again the sori, and this is most common, may be borne simply on the ordinary leaves. They are almost always on the lower surface only; they may entirely cover it, but more often are localised. Into the vexed question of the evolutionary origin of sporangia we cannot enter here.

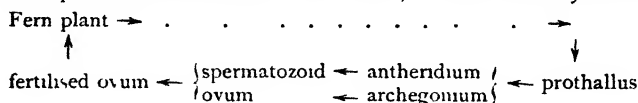
The spores are all of one kind and if sown under suitable conditions give rise to *prothalli*; these are flat green expansions living for a short or long period independently upon the soil (numbers of them may be seen wherever ferns are growing). On the under surface are borne the reproductive organs of both sexes, *antheridia* (male) and *archegonia* (female). The spermatozooids swim to the ova in the water which collects under the prothall during rain. The fertilised ovum develops directly into a new fern-plant.

Two interesting modifications of the life cycle as above described are known. In *Pteris cretica*, *Nephrodium Filix-mas*, *Aspidium falcatum* and *Todea africana*, there occurs *apogamy* or the omission of the sexual process from the life-history (see diagram in art. Pteridophyta). The new fern-plant is produced from the prothallus by a

process of budding; a growing point developes from the cells of the prothallus. The cycle thus runs:



The other case, *apospory*, is found in *Athyrium Filix-femina* var. *clarissima*, and in *Polystichum angulare* var. *pulcherrimum*, &c Here spore-formation is replaced by a process of budding, which gives rise to prothalli on the backs of the leaves, so that the life-cycle runs



This latter case must not be confused with the 'vivipary' of *Asplenium bulbiferum*, &c, where the leaf tissue buds out directly into new plants which for a time remain attached to the parent, but ultimately drop off and grow independently. This case is analogous to that of many phanerogams (see p 114, and cf *Bryophyllum* &c.).

*Natural History of Ferns* A very large number of ferns are shade and moisture loving plants. This is comprehensible enough when we remember how dependent they are on water for their fertilisation. Many however are xerophytes and alpine forms with reduced transpiration. These exhibit the familiar characters (see Ch. III) of such plants—reduced surface, thick cuticle, hairiness, incurving of leaves (cf *Ericaceae*), and even, though but rarely, succulence (*Polypodium adnascens*, *Drymoglossum carnosum*, &c). The tree ferns and many others have water storage tissue in the stem.

Many sp are epiphytic, especially in the tropics, though wherever the air is sufficiently damp they may be found growing in this way, even in Britain (p 186). The most interesting epiphyte is *Platycerium*; see also *Polypodium* &c.

The spores of ferns, consisting only of one cell, are of course much lighter than is possible for a seed, and may be carried by wind to enormous distances. Owing to this the ferns of to-day are much more widely distributed than the flowering plants—species for species; and further, owing to the greater age of the family in geological time, it is as a family more widely distributed than the families of flowering plants.

*Classification* (after Campbell). there are 6 orders.

1. *Osmundaceae* (sporangia shortly stalked with a group of peculiarly shaped cells at one side of the apex; they open by a longitudinal fissure on the other side; fertile and sterile pinnae).
2. *Gleicheniaceae* (sporangia sessile, 3 or more in a sorus without

indusium, with complete transverse annulus and longitudinal dehiscence, creeping rhizome, leaves dichotomous)

- 3 *Hymenophyllaceae* (sporangia with oblique or transverse complete annulus, opening by longitudinal fissure, they are marginal with a cup-shaped indusium, stem slender, often creeping; mesophyll usually one cell thick)
- 4 *Schizaceae* (sporangia sessile with cap of thick walled cells at apex instead of a ring like annulus, and with longitudinal dehiscence, indusium or none, sporangiferous pinnae usually in spikes or panicles)
- 5 *Cyatheaceae* (sporangia shortly stalked with complete oblique excentric annulus, sorus naked or with cup like indusium, mostly tree ferns)
- 6 *Polypodiaceae* (sporangia stalked with vertical incomplete annulus, and dehiscing transversely)

For relationship, see art. Filicineae

2. *Heterosporous F. L.* (*Hydropterideae* or *Rhizocarpaceae*) The two orders of which this group is composed, though they have much in common, are almost certainly derived from different stocks amongst the ferns. For details reference should be made to the orders

As in the homosporous forms, so here the embryo gives rise directly to a new leafy plant. This is usually aquatic in habit, and exhibits a creeping stem with a dorsoventral arrangement of the leaves. Roots may or may not be formed. The stem grows by means of an apical cell. The sporangia are enclosed in capsular structures termed *sporocarps*. In the *Salvinaceae* this body contains one sorus only, in the *Marattiaceae* more than one. The sorus in the former is composed of one kind of sporangium only, in the latter usually of both. The spores germinate in water, the megaspore gives rise to a small green female prothallus which remains enclosed in the burst spore. Its free surface bears a few archegonia. The microspore gives rise (some times without escaping from the sporangium) to a rudimentary male prothallus and an antheridium. From the latter the spermatozooids escape and swim to the female organ.

#### *Classification*

Order 1. *Salvinaceae* (sporocarps unilocular).

2. *Marsiliaceae* (sporocarps plurilocular).

For general relationships, see Filicineae.

**Fimbristylis** Vahl. Cyperaceae (i) 200 sp. chiefly trop.

**Fistularia** Linn. = *Rhinanthus* Linn.

**Fitzroya** Hook. f. Coniferae (Arauc. 2a; see C for genus characters). 2 sp. Chili, Tasm.

**Flacourtia** (Comm.) L'Hérit. Flacourtiaceae. 15 sp. trop. As., Afr. *F. Ramontchi* L'Hérit., the Madagascar plum, and others have edible drupes.

**Flacourtiaceae.** Dicotyledons (Archichl. Parietales). 70 gen. with 500 sp. of trop. (a few subtrop.) trees and shrubs. They have mostly alt. stip. leathery leaves, frequently more or less two ranked. The flrs. are solitary or in racemose, cymose, or mixed inflls., and are very commonly unisexual. The axis is convex, and between petals and sta. it forms a disc or gives rise to various effigurations, commonly glands or scales. The flr. is 4—5- (or more) merous, usually regular, sometimes apetalous. Sta.  $\infty$ , sometimes united into ante-petalous groups, the anthers almost always opening by lateral slits. Ovary superior or semi-inferior, 1-loc., with 2—8 (usually 3—5) parietal placentae, which often project far into the cavity. Ovules  $\infty$ , always anatropous. Styles as many as placentae, or united. Fruit usually a capsule or berry. Embryo straight, in copious endosperm. *Chief genera:* Erythrospermum, Oncoba, Homalium, Myroxylon, Azara, Flacourtia, Casearia. Benth.-Hooker and Warming unite F. to Bixineae.

**Flagellaria** Linn. Flagellariaceae. 2 sp. trop. Afr., As., Fiji.

**Flagellariaceae.** Monocotyledons (Farnosae). 3 gen. (Flagellaria, &c.) with 8 sp., trop. Afr., As., Indo-mal., &c. See *Nat. Pl.*

**Fleurya** Gaudich. Urticaceae (1). 8 sp. trop.

**Flindersia** R. Br. Rutaceae (VII). 12 sp. E. Austr., New Caled., Amboina. Placed in Meliaceae by Benth.-Hooker.

**Foeniculum** Tourn. ex Linn. Umbelliferae (6). 3 sp. Medit., Eur. *F. vulgare* Mill. (fennel, on sea-cliffs in Brit. The fruit of *F. officinale* All. is used as a condiment and the young leaves are eaten as a vegetable.

**Fontanesia** Labill. Oleaceae (1. 1). 1 sp. Sicily to Palestine.

**Forestiera** Poir. Oleaceae (1. 3). 14 sp. Am.

**Forskohlea** Linn. Urticaceae (5). 5 sp. Medit., Afr., E. Ind.

**Forsythia** Vahl. Oleaceae (1. 2). 2 sp. China, often cultivated against walls.

**Fothergilla** Murr. Hamamelidaceae. 2 sp. Kashmir and atlantic N. Am. Flrs. apetalous; sta. numerous.

**Fouquieria** H. B. et K. Tamaricaceae. 3 sp. Mex., Calif., Texas. Shrubs with deciduous leaves, whose midrib persists and forms a thorn (cf. Caesalpinia, Combretaceae, &c.). Gamopetalous. *F. splendens* Engelm., the ocotilla or coach-whip, is used in hedge making.

**Fourcroya** Spreng. = Furcraea Vent.

**Fragaria** (Tourn.) Linn. Rosaceae (III. 6 b). 8 sp. N. temp. and Andes. *F. vesca* L., the wild strawberry in Brit. Vegetative propagation by runners (p. 164) is well shown in this plant. The flr. is protogynous, and has an epicalyx. The fruit is composed of a number of achenes (the so-called seeds of the strawberry) borne upon a fleshy receptacle. The flr. bends downwards after fertilisation to ripen the fruit. Several sp. are in cultivation for the sake of the fruit. In America the cultivated forms become dioecious or polygamous.

**Francoa** Cav. Saxifragaceae (11). 2 sp. Chili. See order.

**Frangulinae** (Warming). The 16th cohort of Choripetalae.

**Frankenia** Linn. Frankeniaceae. 31 sp. sea-coasts, temp. and subtrop. *F. laevis* L., sea-heath, in Brit. They are halophytes (see p. 187) with inrolled hairy leaves (cf. *Empetrum*, &c.).

**Frankeniaceae**. Dicotyledons (Archichl. Parietales). 4 gen. with 34 sp. of salt-loving plants, trop. and temp. Herbs with jointed stems; leaves opp., inrolled, exstipulate (?). Flrs. in dichasia,  $\frac{5}{5}$ , regular. K (4—7), C 4—7, A usually 6 in two whorls, sta. slightly united at base. G usually (3), 1-loc. with parietal placentae, only the lower parts of which bear ovules. Ovules  $\infty$ , anatropous, ascending. Style forked. Capsule loculicidal. Mealy endosperm. Embryo straight. *Chief genera*: Frankenia, Niederleinia. The order is closely related to Tamaricaceae and Guttiferae; the agreement with Caryophyllaceae, near to which it is sometimes placed, e.g. by Benth.-Hooker, is more in habit than in structure. It is placed in Cistiflorae by Warming.

**Fraxinus** Tourn. ex Linn. Oleaceae (1. 1). About 40 sp. esp. N. Am., E. As., and Medit. *F. excelsior* L., the common ash, is found in Brit. It has large pinnate leaves, with grooved petioles. Water is said to enter this groove and be absorbed by the leaf; the hollow is usually inhabited by acarids, thus forming a 'domatium' (see p. 117 and Ludwig, *Biologie*, p. 273, &c.). The flrs. appear before the leaves in densely crowded short racemes. Each  $\frac{5}{5}$  flr. consists merely of 2 sta. at right angles to 2 cpls., and is anemophilous; but polygamy is the rule in this sp. and every possible combination of the three types of flr. ( $\frac{5}{5}$ ,  $\frac{5}{3}$ ,  $\frac{5}{2}$ ) occurs in various places, sometimes all on one tree, or two on one and one on another, and so on. The fruit is a samara or one-seeded nut with terminal wing aiding in wind distribution. *F. Ornus* L., the 'flowering ash' of S. Eur., has calyx and corolla.

The wood of the ash is valuable on account of its firm elastic nature.

The weeping ash is a variety propagated vegetatively from a single tree which appeared as a sport at Wimpole in Cambridgeshire.

**Freesia** Klatt. Iridaceae (111). 2 sp. Cape Col. Favourite greenhouse flrs. on account of their delicious scent.

**Frenela** Mirb. = *Callitris* Vent.

**Freycinetia** Gaudich. Pandanaceae. 30 sp. E. Ind., Polynes. Most are climbing shrubs with infl. and flr. like those of *Pandanus*. The bracts are fleshy and usually brightly coloured. In Java, Burck observed in one sp. pollination effected by a bat (*Pteropus edulis*) which devoured the coloured bracts; in so doing it received pollen upon its head and carried it to the female flr. Fruit a berry, not, as in *Pandanus*, a drupe.

**Freylinia** Colla. Scrophulariaceae (11. 6). 2 sp. S. Afr.

**Fritillaria** (Tourn.) Linn. Liliaceae (v). 40 sp. N. temp. *F. Meleagris* L., snake's head, in Brit. Honey is secreted by large nectaries at

the base of the perianth. The bud stands erect and so does the capsule, but the open flr. is pendulous (p. 101).

**Froelichia** Moench. Amarantaceae (4). 10 sp. temp. Am. Fruit enclosed in the perianth, which forms two wings.

**Fuchsia** (Plum.) Linn. Onagraceae (VI). 60 sp. Cent. and S. Am., N. Z. Many are cultivated for their flrs. Many sp. show two buds in each leaf-axil, one above the other (p. 34). The flr. is adapted to bees, humming-birds, &c. The berry is edible.

**Fuirena** Rottb. Cyperaceae (I). 20 sp. trop. and sub-trop.

**Fumaria** Tourn. ex Linn. Papaveraceae (III). 40 sp. Eur., As., Afr., chiefly Medit. 2 in Brit. (fumitory). Many climb by aid of sensitive petioles (cf. Clematis). The flr. is like that of *Corydalis*. *F. capreolata* L. var. *fallidiflora* Jord. (Brit.) shows an interesting colour-change in its flr.; before pollination it is white, and then it gradually turns pink or even carmine (cf. Rubes, Diervilla). This has been described as an adaptation to show the more intelligent insects which are the useful (unpollinated) flrs. (see Muller's *Fert. of Fls.*).

**Fumariaceae** (Warming) = sub-order III of Papaveraceae.

**Funkia** Spreng. (*Hosta* Tratt.). Liliaceae (III). 5 sp. Japan, China. Embryos are formed in the seeds by outgrowth of the nucellus-tissue round the embryo-sac (cf. Aechmea). Seeds winged.

**Furcraea** Vent. Amaryllidaceae (II). 15 sp. trop. Am. Like Agave; the infl. is even more gigantic. *F. gigantea* Vent. yields the fibre known as Mauritius hemp.

**Gagea** Salisb. Liliaceae (IV). 25 sp. temp. Old World. *G. lutea* Ker-Gawl. in Brit. Flr. protogynous. In the leaf-axils of some sp. are buds which, if fertilisation does not occur, develop into bulbils and drop off (p. 115).

**Galnia** Forst. Cyperaceae (II). 32 sp. N.Z., Austr. to China, Polynes.

**Gaillardia** Foug. Compositae (VI). 12 sp. Am.

**Galactia** P. Br. Leguminosae (III. 10). 50 sp. trop. Latex, which is rare in the order, is found in this plant; nothing however seems to be known about the anatomy, &c.

**Galactodendron** Rehb. = *Brosimum* Sw.

**Galanthus** Linn. Amaryllidaceae (I). 6 sp. Eur. *G. nivalis* L., the snowdrop, in Brit. Bulb with 1-flowered scape. Perianth in two whorls. On the inner surface of the inner perianth-leaves are green grooves secreting honey. The bud is erect, but the open flr. is pendulous (p. 101), and adapted to bees. The sta. dehisce by apical slits and lie close against the style. Each has a process going outwards from the anther. The stigma projects beyond the anther-cone and is first touched by an insect. In probing for honey the insect shakes the sta. and receives a shower of pollen (p. 91, and cf. *Erica*).

Autogamy may occur in old flrs. The flr. remains open a long time.

**Galax** Linn. Diapensiaceae. 1 sp. Virginia, Georgia.

**Galeandra** Lindl. Orchidaceae (9). 6 sp. trop. Am. Epiphytes.



- Galega** Tourn. ex Linn. Leguminosae (III. 6). 3 sp. S. Eur., W. As.  
*G. officinalis* L. is sometimes cultivated as a fodder-plant (goat's rue).
- Galeobdolon** Adans. = *Lamium* Tourn.
- Galeopsis** Linn. Labiatae (VI. 4). 7 sp. N. temp. 3 in Brit., including *G. Tetrahit* L., the hemp-nettle, noteworthy for the swollen upper ends of the internodes; these act as pulvini (p. 31). See Briquet's monograph of *G.*, *Mém. cour. Acad. roy. Belg.* LII. 1893.
- Galinsoya** Ruiz et Pav. Compositae (V). 4 sp. Mexico to Argentina.  
*G. parviflora* Cav. is now a common weed on the continent, and is established near Kew.
- Galipea** Aubl. Rutaceae (V). 6 sp. S. Am.
- Galium** Linn. Rubiaceae (II. 21). Over 200 sp. mostly temp., 10 in Brit. (bed-straw, &c.). Herbs with whorls of leaves and stipules (see order), and flrs. in dichasial panicles. Flr. small with honey freely exposed (p. 68) on the epigynous disc; in most sp. it is protandrous with ultimate self-pollination. Of the Brit. sp., *G. verum* L. and *G. Aparine* L. (goose-grass or cleavers) are the most frequent. The latter is a feeble hook-climber (p. 177), with small reflexed hooks on the stem. The schizocarp is also provided with hooks.
- Galtonia** Dcne. Liliaceae (II). 2 sp. S. Afr.
- Gamopetalae** (Benth.-Hooker) = Sympetalae (p. 143).
- Garcinia** Linn. Guttiferae (V). 150 sp. trop. Old World. Trees or shrubs with leathery leaves. Sta. free or united into bundles or into a common mass. Fruit a berry. Seed arillate. The resin of *G. Cambogia* Desv. and other sp., obtained by cutting notches in the stem, forms gamboge. The fruit of many sp. is edible, especially that of *G. Mangostana* L., the mangosteen; it is the aril of the seed of this which is esteemed as a delicacy. Some sp. yield useful timber.
- Gardenia** Ellis. Rubiaceae (I. 8). 60 sp. trop. Old World. They are largely cultivated for their showy strongly-scented flrs. Some sp. have apparently whorls of leaves, 3 in each. This is really a case of condensation of two whorls of 2 into one with extreme anisophylly (p. 38) of one whorl; the fourth leaf is reduced to a minute scale. The stipules of many sp. secrete a resinous fluid.
- Garidella** Tourn. ex Linn. = *Nigella* Linn.
- Garrya** Dougl. ex Lindl. Cornaceae. 8 sp. Calif., Mexico, W. Ind.  
*G. elliptica* Dougl. is often found in shrubberies. The flrs. are in catkins; 3 flrs. occur in the axil of each bract.
- Gasteria** Duval. Liliaceae (III). 35 sp. S. Afr. Xerophytes with succulent leaves closely packed together (p. 182), but living in the shade of long grass, &c.
- Gastrochilus** Wall. Zingiberaceae. 2 sp. Himal., Burmah.
- Gastrolobium** R. Br. Leguminosae (III. 2). 32 sp. W. Austr.
- Gaudichandia** H. B. et K. Malpighiaceae (I). 12 sp. Mexico to Venezuela. Mericarp elevated on carpophore formed from wing of cpl.
- Gaultheria** Kalm. Ericaceae (II. 5). 100 sp. Am., Japan to Himal.

and Tasmania. *G. procumbens* L. is the winter green, checker-berry or partridge-berry of the U S. The fruit resembles a berry, but is really a capsule, enclosed in the fleshy calyx but not adhering to it. *G. Shallon* Pursh is the Sallal or shallon of N.W. Am., whose edible fruit deserves to be more widely known and cultivated. An oil is distilled from the plant of some sp.

**Gaura** Linn. Onagraceae (v) 20 sp. N. Am. The anthers are chambered up by horizontal septa in each loc. (cf *Circaea*). Nut.

**Gaya** H B et K. Malvaceae (II). 6 sp. trop. Am.

**Gaylussacia** H B et K. Ericaceae (III 7) Over 40 sp. Am (huckleberry). The 5 loc. of the ovary are made into 10 by partitions growing out from the midribs of the cpls, as in *Linum*.

**Gazania** Gaertn. Compositae (X) 24 sp. Cape Colony

**Geissoloma** Lindl ex Kunth *G. marginatum* Kunth, Cape Col., a small xerophytic shrub is the only sp. The genus forms the order Geissolomaceae

**Geissolomaceae** Dicotyledons (Archichl. Thymelaeales). 1 gen. *Geissoloma*. A monotypic order united to Penaeaceae by Benth.-Hooker

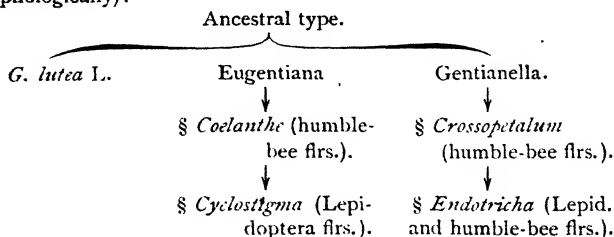
**Gelsemium** Juss. Loganiaceae 2 sp. N. Am., As. *G. sempervirens* Ait. is known as Carolina jasmine. The peduncle bears a large number of bracteoles

**Genista** Linn. Leguminosae (III 3) 80 sp. Eur., N. Afr., W. As.; 3 in Brit. *G. angustula* L. (needle gorse or petty whin) has large thorns (branches). The flr. has an explosive mechanism, typical of many of the order (see Leguminosae). In *G. tinctoria* L., the dyer's greenweed (see Muller's *Fert. of Flrs* p. 189), there is no honey; the style and tube of sta. are enclosed in the keel, which is united along the top seam as well as the bottom. The sta. shed their pollen almost in the apex of the keel, but not so near it as to pollinate the stigma. When the flr. opens there is a tension of the sta.-tube on the lower side tending to bend it upwards, this is resisted by an opposite one in the keel and wings, but if an insect alight on the wings and press them down, the upper seam of the keel gives way and an explosion follows. In it the style flies out, striking the under side of the insect, thus probably becoming cross pollinated, and is followed by a shower of pollen which gives the insect a fresh coating to take to another flr.

A yellow dye is obtained from the flrs. of this sp., which when mixed with woad gives a fine green (Kendal green).

**Gentiana** Tourn. ex Linn. Gentianaceae (I. 3) 300 sp. chiefly alpine, Eur., As., N. Am., Andes. Austr., N. Z.; 5 sp. of gentian in Brit. Most are alpine plants of tufted growth (p. 190). The flrs. are of much interest (see *Nat. Pl.*, Muller's *Fert. of Flrs.*, *Alpenblumen*, &c.). The genus divides into two subgenera, according to the position of the nectaries—in *Eugentiana* on the base of the ovary, in *Gentianella* on the base of the corolla. In each section we find an ascending

series of flrs., adapted to higher and higher types of insects. The more common sp. may be thus grouped (biologically and to a large extent morphologically):



In *G. lutea* L. the honey is freely exposed (p. 64), the corolla being rotate; the visitors are mostly short-tongued. The colour too is yellow (p. 96) and the flr. is homogamous. To § *Coelanthæ* belong *G. purpurea* L., *G. Pneumonanthe* L., &c. The latter sp. (Brit.) has a blue corolla with a long tube, is protandrous and visited by humble-bees (class H, p. 70). To § *Cyclostigma* belong *G. bavarica* L., *G. verna* L., *G. nivalis* L., &c.; *G. verna* (Brit.) resembles *G. Pneumonanthe* but has a still longer and narrower tube and is visited by Lepidoptera. Turning to the other division, we find similar phenomena. *G. ciliata* L. (§ *Crossopetalum*) is a protandrous bee-flr., *G. Amarella* L. (Brit.; § *Endotricha*) a homogamous bee- and Lepidoptera-flr. *G. campestris* L. (Brit.) is similar. This sketch of the probable course of evolution of the gentians is of course hypothetical, but not more so than most hypotheses of the evolution of existing forms of life. It is a good illustration of the general argument of the Theory of Flowers set forth on pp. 59—71, which should be carefully read in connection with this article.

The gentians form one of the most striking features of the flora of the Alps, occurring in large masses and with very conspicuous flrs.; *G. acaulis* L. is the most beautiful. In the Brit. Mts. they are rare. The root of *G. lutea* furnishes a tonic.

**Gentianaceae.** Dicotyledons (Sympet. Contortae). 64 gen. with 750 sp. The order has representatives in every part of the globe and in a great variety of situations—arctic and alpine plants, halophytes, saprophytes (*Voyria*, &c.), marsh plants (*Menyanthes*, &c.), water plants (*Limnanthemum*), &c. They are mostly herbaceous plants (often perennial), but a few shrubs occur. The perennial herbs have usually a rhizome. Leaves opp., exstip., usually entire. The infl. is usually a dichasial cyme like that of Caryophyllaceae; as in that order, the lateral branches often become monochasial. Other cymose infls. also occur. Bracts and bracteoles present or not. Flrs. regular, ♂, 4—5-merous (rarely more). K usually (5), imbric-

cate; C (5), bell- or funnel-shaped, or sometimes salver-shaped, convolute (exc. *Bartonia*, *Obolaria*, &c., and sub-order 11). Sta. as many as petals, alternate with them, epipetalous; anthers various, usually introrse. Gynœceum with a glandular disc at the base, of (2) cpls., syncarpous, superior, placed in the antero-posterior plane. Placentae usually parietal, but they commonly project far into the cavity and spread out at their ends; occasionally the ovary is 2-loc. with axile placentation. Ovules usually  $\infty$ , anatropous. Style simple; stigma simple or 2-lobed. Fruit usually a septicidal capsule with  $\infty$  seeds, rarely a berry (*Chironia*, &c.). Seeds small. Embryo small, in abundant endosperm.

The flowers of *G.* are insect-fertilised. The genus *Gentiana* has been very fully studied; see also *Menyanthes* (dimorphic).

*Classification and chief genera* The grouping of the order by Gilg in *Nat. Pfl.* is largely based on the characters of the pollen, and is thus of little use for the purposes of this book; Engler classifies the *G.* thus.

- I. *Gentianoideae* (leaves opp.; corolla convol. or imbric.):
  1. *Exacae* (ov. 2-loc.): *Exacum*.
  2. *Chironiceae* (ov. 1-loc. with projecting plac.): *Erythraea*, *Chlora*.
  3. *Swertiaeae* (do. plac. not projecting): *Gentiana*, *Swertia*.
- II. *Menyanthoideae* (leaves alt.; corolla induplicate-valvate):  
*Menyanthes*, *Limnanthemum*.

[Placed in *Gentianales* by Benth.-Hooker, in *Contortae* by Warming.]

**Gentianales** (Benth.-Hooker). The 7th cohort of Gamopetalae (p. 144).  
**Geonoma** Willd. *Palmae* (iv. 6). 80 sp. trop. Am.

**Geraniaceae**. Dicotyledons (Archichl. Geraniales). 11 gen. with 430 sp., cosmop. Mostly herbs, often hairy; *Sarcocaulon* has a fleshy habit. Fls. usually regular,  $\frac{5}{5}$ -merous. K 5, imbricate with valvate tips, persistent; C 5, imbricate or convolute; Sta. as many or 2 or 3 times as many as petals, united at base, chdiplostemonous when more than one whorl. Cpls. (5) or (2-3) or (3-5), with 1-2 or 2- $\infty$  ovules in each on axile placentae. Ovules usually pendulous, with ventral raphe and micropyle facing upwards; style long with 5 stigmas. The flrs. are usually protandrous. Fruit usually a schizocarp, the cpls. splitting off from a central beak (the persistent style). Each takes with it a strip of the tissue of the style, forming an *awn*, which is usually hygroscopic (see *Geranium*, *Erodium*). Embryo straight or folded, in endosperm. *Chief genera*: *Geranium*, *Erodium*, *Pelargonium*, *Sarcocaulon*. Benth.-Hooker unite to *G.* the *Oxalidaceae*, *Limnanthaceae*, *Tropaeolaceae* and *Balsaminaceae*, but there is good reason for separating these from *G.*, especially the last named. They place *G.* in *Geraniales*; Warming places the order, defined as by Engler, in *Gruinales*.

**Geraniales**. The 15th cohort (Engler) of Dicotyledons (Archichl.).

See p. 137. The 7th cohort (Benth.-Hooker) of Polypetalae (p. 142).

**Geranium** (Tourn.) Linn. Geraniaceae. 160 sp. temp. (12 in Brit. of which *G. pratense* L., meadow cranesbill, and *G. Robertianum* L., herb Robert, are the most noteworthy). The infl. is cymose, either dichasial with a cincinnus-tendency (by preference of the  $\beta$ -bracteole), or a cincinnus alone, which is straightened out into a sympodium. The nectaries are at the base of the sta. These stand at first round the undeveloped style; after dehiscence they move away, and finally the stigmas open. The fruit explodes, the awn twisting up so that the cpls. are carried upwards and outwards. In many sp. they open at the same time and the seeds are shot out. The *G.* of greenhouses is really a *Pelargonium*.

**Gerardia** Linn. Scrophulariaceae (III. 11). 30 sp. Am.

**Gerbera** Gronov. Compositae (XII). 30 sp. Afr., As.

**Gesneria** Linn. Gesneriaceae (II). About 60 sp. trop. Am.

**Gesneriaceae**. Dicotyledons (Sympet. Tubiflorae). About 85 gen. with 700 sp. trop. and sub-trop. Most are herbaceous or slightly woody plants; shrubs and trees are rare. Leaves usually opp., rarely whorled or alt., entire or toothed, never divided, exstip. Some are root-climbers, and amongst these are a few epiphytes, e.g. *Aeschynanthus*, usually with fleshy water-storing leaves. Many are tuberous plants, e.g. the familiar *Sinningia* (*Gloxinia*) of our greenhouses. A number of sp. reproduce vegetatively by means of curious runners or suckers, covered with scale-leaves; these are usually formed below ground; instances are *Naegelia*, *Isoloma*, &c. A very peculiar morphology and life-history is found in *Streptocarpus* (q.v.).

Flrs. solitary or in cymose infls. of various types,  $\S$ , usually markedly zygomorphic. K (5), usually with very short teeth, generally valvate; C (5), often 2-lipped, imbricate (in *Ramondia*, &c. it is nearly rotate and regular); A usually 4, didynamous, sometimes 2, sometimes 5 (*Ramondia*, &c.), alt. with corolla-lobes; staminodes are often found. At the base of the flower-tube is a disc, whose various shapes form important marks in distinguishing the genera; it may be ring-shaped (thin or thick), 5-angled, 5-lobed, or reduced to 5 or fewer glands. The ovary may be superior, or more or less inferior (see below); it is always of (2) cpls., 1-loc. with parietal placentae which sometimes project inwards so far that it becomes imperfectly 2-loc. Ovules  $\infty$ , anatropous. Style simple; stigma often bilobed. Fruit usually a capsule, splitting loculicidally into 2 valves, each of which may again split into 2; sometimes (*Ramondia*) the capsule is septicidal, or opens only at the tip, or the fruit may be more or less fleshy or berry-like. Seeds small and numerous, with endosperm (§ 11) or without (most of § 1). Embryo straight.

The flrs. are mostly protandrous; their large size and bright

colours indicate insect-fertilisation, but nothing is known about the details. *Saintpaulia* (*q v*) exhibits two types of floral symmetry on the same plant.

None of the *G* are economic plants; many are hothouse favourites.

*Classification and chief genera* (after Fritsch)

"The relationships to allied orders, especially Scrophulariaceae, Orobanchaceae and Bignoniaceae, are so close that it is almost impossible to draw the dividing lines. The *B* are most sharply marked off by the structure and formation of their fruit and seed, and often by their divided leaves. The *O* might very well be placed in *G*. as a parasitic sub order. The placentation and structure of the ovary is the chief mark of distinction between the *G*, *O*, and *S*."

I *Cyrtandroideae* (ovary free, superior) *Ramondia*, *Saintpaulia*, *Didymocarpus*, *Streptocarpus*, *Aeschynanthus*, *Besleria*, *Cyrtandra*, *Columna*

II *Gesnerioideae* (ovary more or less inferior) *Achimenes*, *Iso-loma*, *Gesneria*

[Placed in *Personales* by Benth. Hooker, in *Personatae* by Warming.]

**Gethyllis** Plum. ex Linn. *Amaryllidaceae* (I) 9 sp. Cape Col.

**Geum** Linn. *Rosaceae* (III 6 c) 36 sp. N and S temp., arctic. *G. rivale* L., the water avens, with a thick rhizome and large protogynous fls. is frequent, and *G. urbanum* L., wood avens, with smaller nearly homogamous fls., abundant in Brit. Both sp. with many others of the genus, have a hook on each achene of the fruit to aid in distribution. If the style be examined in a newly opened flr. it will be found to have a Z like kink in it. The lower half of this after fertilisation gets larger and more woody, while the upper half finally drops off. The root of *G. urbanum* is very astringent, containing much tannin.

**Gilia** Ruiz et Pav. *Polemoniaceae* 90 sp. temp. and subtemp. Am.

**Gillenia** Moench. *Rosaceae* (I 1) 2 sp. N. Am.

**Ginkgo** Linn. *Coniferae* (*Taxaceae*, see C for genus characters). 1 sp., *G. biloba* L. (*Salisburia adiantifolia* Sm.), China, Japan, the maiden hair tree, often grown in parks, and always recognisable at a glance by its leaves, which resemble those of the maiden hair fern. In former ages the genus was widely spread. Sp. occur in the Tertiary strata of England. There are 'long' and 'short' shoots, the latter bearing a few scale leaves and several of the curious green leaves, with their *forked* venation (cf *Cycads* and *Ferns*). The leaves are deciduous and the short shoot bears a new set each year. The fls. are dioecious, in the axils of the uppermost scales or lowest green leaves of a short shoot (so that their position differs from the usual one in *Conifers* with long and short shoots). The male has the form of a loose catkin of stam. The female is long-stalked, with two ovules borne on rudimentary cpls. (see order). Seed usually one only, with fleshy aril. The seed is 'ripe' and falls from the tree before fertilisation of the ovule takes place; this process, and the embryo-

development occur on the ground during the winter. The seed is edible, and yields an oil. The timber is useful.

**Girardinia** Gaudich. Urticaceae (1). 6 sp. trop. As., Afr.

**Githago** Adans. = *Lychnis* Linn.

**Gladolus** (Tourn.) Linn. Iridaceae (111). 90 sp. S. Afr., trop. Afr., Eur., As. Favourites in horticulture. Flrs. in many sp. protandrous. Leaves isobilateral.

**Glaucium** Tourn. ex Hall. Papaveraceae (11). 12 sp. Eur., As. *G. flavum* Crantz, yellow horned-poppy, on sea-shores in Brit. (p. 187).

**Glaux** (Tourn.) Linn. Primulaceae (111). *G. maritima* L., sea milk-wort, the only sp., N. temp. maritime (incl. Brit.). A halophyte (p. 188) with fleshy leaves. The seedling plant dies after producing in the axil of one cotyledon a hibernating shoot, with a root of its own. From this new plant fresh plants arise vegetatively, the process being repeated for several years before flowering. Runners with scale leaves in whose axils renewal-shoots form, appear before the flowering period (see Pax in *Nat. Pfl.* for details). The flr. has no corolla, but 3 coloured calyx.

**Glaziovia** Benth. et Hook. f. Bignoniaceae (1). 1 sp. Brazil. The tendrils have flat discs at the tip, which adhere like those of the Virginian creeper (*Vitis* *q.v.*).

**Glechoma** Linn. = *Nepeta* Linn.

**Gleditschia** Clayton. Leguminosae (11. 7). 11 sp. sub-trop. Am., As. The stems are usually provided with stout branched thorns (stem structures, arising in leaf axils). The thorn comes from the uppermost of a whole series of buds arranged one above the other in the leaf axil. No winter buds are formed, and the young apex of each twig dies off in winter, the next year's growth starting laterally. Some sp. are used for hedges; some yield useful timber.

**Gleichenia** Sm. Gleicheniaceae. 30 sp. trop. and S. Hemisph. They have creeping rhizomes; the leaves are repeatedly branched in an apparently dichotomous way.

**Gleicheniaceae**. Filicineae Leptosporangiatæ (Homosporous). 2 genera with 40 sp., trop., sub-trop. and S. temp. They are small ferns with creeping rhizomes and dichotomously branched leaves. Sorus of 2—8 sessile sporangia, without indusium, with a complete transverse annulus, and dehiscing longitudinally. *Chief genus*: *Gleichenia*.

**Globba** Linn. Zingiberaceae. 24 sp. E. Ind. and Malaya. The flr. is rather complex. There is a short calyx; above this is the corolla tube, from the end of which spring 3 petals, a large labellum and 2 stamens, also the slightly petaloid fertile sta., projecting beyond which is the style. The ovary is 1-loc. with parietal placentæ. The lower cymes are usually replaced by bulbils; the mass of one of these consists (see fig. in *Nat. Pfl.*) of a root, springing laterally from the axis.

**Globularia** Tourn. ex Linn. Globulariaceae. 17 sp. Medit., Eur.

*G. vulgaris* L., &c., occur in the Alps; "the only instance in the German and Swiss flora of a blue colour produced by the selective agency of Lepidoptera" (Müller).

**Globulariaceae.** Dicotyledons (Sympet. Tubiflorae). 3 gen. with 20 sp., Eur., Medit., Afr. Herbs or shrubs with alt., exstip., simple leaves and heads or spikes of fls. with or without involucre of bracts. Flr. ♂. K (5), persistent; C (5), median-zygomorphic; the upper lip of 2 petals is shorter than the 3-petalled lower lip; A 4, didynamous, epipetalous. Ovary superior, 1-loc., with 1 pendulous anatropous ovule. Fruit a one-seeded nut, free in base of calyx. Embryo straight, in endosperm. *Chief genus*: Globularia. Benth.-Hooker unite the order to Scлагineae (see Scrophulariaceae); Warming places it in Nuculiferae.

**Glochidion** Forst. Fuphorbiaceae (A. 1. 1). 135 sp. trop. As., Polynes.

**Gloriosa** Linn. Liliaceae (1). 3 sp. trop. As., Afr. Favourite greenhouse plants. They climb by aid of the leaves, whose tips twine like tendrils (p. 177). Flr. pendulous, with the sta. and style projecting horizontally.

**Glossocomia** Rehb. = Codonopsis Wall.

**Glossodia** R. Br. Orchidaceae (4). 5 sp. Austr. At the base of the labellum are two more or less joined projections, which are perhaps equivalent to the divided staminode of the median sta. of the inner whorl (see order).

**Glossostigma** Wight et Arn. Scrophulariaceae (11. 8). 3 sp. Austr., N. Z., trop. As., Afr.

**Gloxinia** L. Hent. Gesneriaceae (11). 6 sp. trop. Am. For *G. speciosa* Lodd, &c., so often cultivated in hot-houses, see Sinningia

**Glumaceae** (Benth. Hooker). The 7th series of Monocotyledons (p. 145).

**Glumiflorae.** The 3rd cohort (Engler) or 2nd (Warming) of Monocotyledons (pp. 135, 146)

**Glyceria** R. Br. Gramineae (x). 16 sp. cosmop., esp. N. Am. 2 in Brit. Pasture grasses in wet meadows.

**Glycine** Linn. (incl. *Soja* Moench.). Leguminosae (111. 10). 16 sp. trop. Afr., As., Austi. *G. Soja* Sieb. et Zucc. and *G. hispida* Maxim. yield Soja beans, eaten in Japan, &c. and used as green fodder. An oil is obtained from the seeds.

**Glycosmis** Correa. Rutaceae (x). 6 sp. trop. Afr., Ind., Austi. Fruit edible.

**Glycyrrhiza** Tourn. ex Linn. Leguminosae (111. 6). 12 sp. temp. and sub-trop. An extract of the rhizome of *G. glabra* L. forms Spanish liquorice.

**Glyptostrobus** Endl. Coniferae (Arauc. 1 c.; see C. for genus characters). 2 sp. China, *G. pendulus* Endl. and *G. heterophyllus* Endl. United to Taxodium by Benth.-Hooker.

**Gnaphalium** Linn. Compositae (IV). 120 sp. cosmop.; 4 in Brit.



(cudweed). *G. supinum* L., found in alpine regions in Scotland, is a tufted hairy xerophyte (p. 192). [For *G. dioicum* L. see Antennaria, for *G. Leontopodium* L. see Leontopodium.]

**Gnetaceae.** The only order in the third and highest class of the Gymnosperms, comprising 3 very distinct genera with about 40 sp. trop. and sub-trop. These agree in very few points, and ought perhaps to form separate natural orders. They are distinguished from the Coniferae by the absence of resin, by the presence of vessels in the secondary wood, and by the occurrence of a perianth. For details of structure reference must be made to the genera; see also Gymnospermae.

*Genera:* Ephedra, Gnetum, Welwitschia.

**Gnetum** Linn. Gnetaceae. 15 sp. trop. Most are climbing shrubs, a few erect shrubs or small trees. Leaves decussate, exstip., simple, evergreen, leathery. Flrs. dioecious, in spikes which are frequently grouped into more complex infls. The spike bears decussate bracts, in whose axils are condensed partial infls. of a large number of flrs. (cf. Labiatae), about 3—8 in the ♀, but more (up to 40) in the ♂. These flrs. form whorls round the stem, and are intermingled with numerous hair-structures. At the top of the ♂ infl. are sterile ♀ flrs. The ♂ has a tubular (2-leafed) perianth, from the top of which the axis projects; at the tip of the axis, right and left, are two sessile 1-loc. anthers. The ♀ has a tubular perianth like that of Ephedra, surrounding a single orthotropous erect ovule with two integuments; the inner of these projects at the apex of the flr. After fertilisation the perianth becomes fleshy, the outer integument woody, forming a drupe-like fruit. *G. Gnemon* L. (Malay) and other sp. are cultivated for the edible fruit. [See Gymnospermae, and Karsten in Cohn's *Beitrag* vi., *Bot. Zeit.* 1892, *Ann. Buitenz.* xi. &c.]

**Gnidia** Linn. Thymelaeaceae. 90 sp. Afr., Madag., E. Ind.

**Godetia** Spach = Oenothera Linn.

**Goethea** Nees. Malvaceae (III). 2 sp. Brazil. Closely allied to Pavonia, some sp. of which are often placed in *G.* There are several buds in each leaf-axil, some of which give rise years later to flrs., borne on the old wood (p. 35). The epicalyx is brightly coloured. The corolla does not spread out, but the styles first emerge and afterwards the sta. (the reverse of the usual behaviour in Malvaceae). Honey is secreted at the base of the calyx. The styles are twice as numerous as the cpls. (see Pavonia).

**Goldfussia** Nees = Strobilanthes Blume

**Gomphia** Schreb. (*Ouratea* Aubl.). Ochnaceae. 120 sp. trop. Am., As., Afr. Like Ochna, but sta. 10 only.

**Gomphocarpus** R. Br. Asclepiadaceae (II. 2). 100 sp. trop. and South Afr., and S. Am. *G. fruticosus* R. Br. is wild on the shores of nearly all trop. lands, having spread from Afr.

**Gompholobium** Sm. Leguminosae (III. 2). 24 sp. Austr.

**Gomphrena** Linn. Amarantaceae (4). 90 sp. S. Am., Austr. Herbs with cymose heads of flrs. Flr. ♀ with 5 hairy perianth-leaves and 5 sta. united into a tube.

**Gonatanthus** Klotzsch. Araceae (vi). 2 sp. Himal.

**Gongora** Ruiz et Pav. (*Acropera* Lindl.). Orchidaceae (19). 20 sp. trop. Am. Epiphytes with hanging flrs. whose ovary is so bent that the labellum comes to stand above the column. The sepals and petals spring from the column (an argument for its axial nature). See Darwin, *Orchids*, p. 166.

**Goniolimon** Boiss. = *Statice* Tourn.

**Gonolobus** Michx. Asclepiadaceae (11. 5). 70 sp. Am.

**Goodenia** Sm. Goodeniaceae (1). 70 sp. Austr.

**Goodeniaceae.** Dicotyledons (Sympet. Campanulatae). 12 gen. with 210 sp., chiefly Austr., a few N.Z., Polynes., and trop. coasts. Herbs and shrubs with alt. exstip. leaves and no latex. Flrs. ♀, zygomorphic, solitary in the leaf-axils or in cymes, racemes, or spikes. K usually 5, small; C (5); A 5, alt. with the petals, epipetalous or not, with introrse sometimes syngenesious anthers; G (2), inferior or semi-inferior, rarely superior, 1- or 2-loc.; style simple with 'pollen-cup' close under the stigma. Into this the pollen is shed in the bud; "the cup then closes up, leaving only a narrow opening for the most part covered by hairs. At the same time the style bends down to stand in the mouth of the almost horizontal flr., so that insect-visitors come in contact with the hairs and dust themselves with a little of the powdery pollen. As the stigmatic lobes grow up in the cup they keep forcing fresh pollen into the narrow slit, and finally emerge by it themselves and then receive the pollen of younger flrs. from insect-visitors" (Mullet). The mechanism should be carefully compared with that of Campanulaceae and Compositae. Ovules usually ascending, anatropous. Fruit usually capsular, sometimes a nut or drupe. Embryo straight, in fleshy endosperm.

*Classification and chief genera* (after Schonland): The G. are very closely allied to Campanulaceae, differing chiefly in the absence of latex and the presence of the pollen-cup. They resemble Gentianaceae in a few points.

I. **GOODENIOIDEAE** (flrs. rarely in heads; corolla folded in bud; ovary inf. or  $\frac{1}{2}$ -inf., with usually 2 or more ovules; endosperm): *Velleia*, *Goodenia*, *Leschenaultia*, *Selliera*, *Scaevola*, *Dampiera*.

II. **BRUNONIOIDEAE** (flrs. in heads; corolla valvate; ovary sup., 1-ovuled; no endosperm): *Brunonia* (only genus).

[Placed in Campanales by Benth.-Hooker, in Campanulinae by Warming.]

**Goodenovieae** (Benth.-Hooker) = Goodeniaceae.

**Goodia** Salisb. Leguminosae (111. 3). 2 sp. S. Austr.

**Goodyera** R. Br. Orchidaceae (4). 25 sp. N. temp., trop. As., New

Caled., Mascarenes; *G. repens* R. Br. in Brit. Flr. as in *Epipactis* (Darwin, *Orchids*, p. 103).

**Gordonia** Ellis. Theaceae. 16 sp. Indo-mal, China, N. Am. Seeds winged. The bark of *G. Lasianthus* Linn. (loblolly-bay, south U.S.) is employed for tanning. Sta. opp. to petals.

**Gossypium** Linn. Malvaceae (14). 9 sp. trop. and sub-trop. Epicalyx of 3 leaves. G (5). Loculicidal capsule. The seeds are covered with long hairs for wind-dispersal, these hairs form the material known as cotton. The cultivated forms are apparently reducible to 3 sp., *G. barbadense* L. (trop. Am.), *G. arboreum* L. (Old World), and *G. herbaceum* L. (ditto). The cotton separates easily from the seed in the first sp., which is the one most cultivated in the U.S.; in Egypt, India, &c. the other sp. are most used. From the seeds an oil is obtained by crushing (cotton-seed oil), and the oil cake left behind is largely used for feeding cattle, &c. The fls. are visited by bees and (in Am.) by humming-birds. For details see Mueller's *Select Extratrop. Plants*.

**Gouania** Jacq. Rhamnaceae 40 sp. trop. Some have watch-spring tendrils (p. 177). The stalks of some sp. contain saponin.

**Gramineae** Monocotyledons (Glumiflorae). One of the largest orders of flowering plants, with about 310 gen. and 3600 sp. found in all regions of the globe. In the temperate zones especially they are a most important feature in the vegetation, forming prairies, steppes, &c. (p. 198). Most grasses are herbaceous, but a few, chiefly the bamboos, reach a large size, even as much as 100 ft. in height. Many are annual, but many are perennial. The latter commonly branch largely from their lower nodes and thus often give rise to a tufted habit (as seen in many common sp.), many sp. possess rhizomes. The stem has well-marked nodes, composed chiefly of softer tissues. If a stem be bent downwards (as occurs when wheat is 'laid') these nodes recommence growth, growing more rapidly upon the lower side, so that the stem is once more brought to the vertical position. The stem is usually hollow (exc. *Zea*, *Saccharum*, &c.) and circular in section. The leaves are alt., and with few exceptions, in 2-ranked phyllotaxy (p. 37); they have a sheathing base, the edges of the sheath overlapping one another upon the side of the stem opp. to the blade (cf. *Cyperaceae*); there is no petiole (exc. in a few bamboos, &c.), and at the junction of blade and sheath there is a little membranous outgrowth, termed the *ligule*, upon the upper side of the leaf. The blade is usually linear. Many xerophytic grasses have grooves along the upper side of the leaf, with the stomata at the bases of the grooves (p. 179); in most of these cases the leaf rolls up upwards in dry air, so as to enclose the stomata completely and check transpiration, the lower surface which thus becomes the outer one, is covered with thick-walled cells and has no stomata. When the air again becomes moist the leaf unrolls.

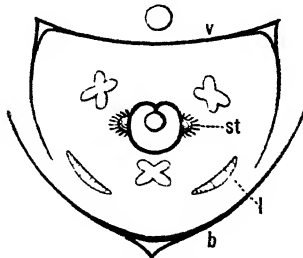
The infl. is rather complex; the unit of infl. is not the individual flr. but a *spikelet*, or small spike of flrs. These are well seen in oats, where the spikelets are arranged in a panicle; in wheat the spikelets are sessile upon the main axis, forming a compound spike, usually termed simply a spike (p. 50); this is more clearly seen in rye-grass. Each of these spikelets consists of one or more (usually not more than 5) flrs. one above the other on opp. sides of a very short axis, the whole enclosed in one or two or more larger leaves at the base of the axis, the *glumes*. The first diagram gives a rough

representation of the construction of a spikelet. The central line represents the axis (supposed elongated), which bears at the base usually two leaves with nothing in their axils; these are the glumes. Above them stand one or more leaves, the *inferior paleae*, in whose axils occur flrs. (sometimes aborted). The flr. is very reduced (or primitive, see p. 60). Upon its axis, opposite to the inferior palea, stands another leaf, the *superior palea*. Between the paleae the flr. itself is enclosed. The superior palea, being upon the same axis as the flr., is evidently its bracteole. Owing to the shortness of the floral axis, it appears to be in the axil of the inferior palea, or even upon the main axis of the spikelet. Above the superior palea are two very

small scales, the *lodicules*, they are opposite to the superior palea (1 in fig.) and insignificant in size. They are sometimes supposed to represent two of the three leaves of a reduced perianth, but it seems more probable that they really represent a second bracteole and that the flr. is perfectly naked. The flr. itself has usually 3 sta. with long filaments and versatile anthers, and 1 cpl. forming a 1-loc. ovary, with 1 basal erect anatropous ovule, and 1 or more (usually 2) stigmas, which are much branched. This ovary has

sometimes been regarded as formed of more than 1 cpl., but the suture of the posterior side of the ovary (cf. Prunus) seems to point clearly to its being of 1 cpl. only. The two stigmas may then be regarded as developments of the lateral parts of the cpl. whilst the central part (which usually forms the stigma) remains undeveloped; this also is the explanation of the two lodicules placed right and left of the proper position for an upper bracteole.

All the flrs. in the spikelet are enclosed as a rule within the glumes until ready to open. Then the glumes separate, and the hygro-



Floral diagram of a grass (after Eichler). b, inferior palea; v, superior palea; l, lodicule; st., stigma.

scopic lodicules force apart the paleae of the individual flrs. Most sp. in Eur. are protogynous; the sta. grow very rapidly in warm weather and suspend the anthers clear of the paleae so that the loose powdery pollen is easily blown away and may be caught by the large stigma of another flr. (p. 84).

The fruit is a caryopsis (p. 107), *i.e.* an achene whose pericarp is completely united to the seed-coat. Its construction can be well seen in maize (or wheat); at the broad end is the scar of the style, and on the under side at the pointed end is the embryo; on the upper side is the *hilum* or point where the ovule was attached to the wall of the cpl. (the form of this scar is important in classification); the bulk of the seed consists of flowery endosperm. The embryo is straight, with its one cotyledon (*scutellum*) completely enveloping the radicle and plumule (this can be easily made out by dissecting soaked material). The radicle is towards the lower end of the fruit. In germination the cotyledon remains within the seed and extracts the nourishment from the endosperm; afterwards it merely withers away (p. 113). Most grass fruits are sufficiently light to be dispersed by wind, especially as the paleae often remain attached to them and become dry and chaffy. Others have hooks or other adaptations for dispersal. Of special interest is the self-burying arrangement in *Stipa* (*g.v.*), effected by aid of the *awn* (this term is applied to any long thread-like outgrowth of glume or palea). Many grasses, *e.g.* sp. of *Poa* and *Festuca*, are *viviparous*, especially on mountains. The spikelets are replaced by leafy shoots with adventitious roots at their bases. These drop off and grow upon the soil (cf. *Agave*, *Allium*, &c.).

From the economic point of view the G. are only rivalled in importance, if at all, by the *Palmae* and *Leguminosae*. The cereal grasses, *e.g.* *Oryza*, *Triticum*, *Zea*, *Avena*, *Hordeum*, &c. (see p. 208), afford food to a large proportion of the earth's inhabitants. Many grasses are valuable as fodder for domestic animals (see p. 210), or for hay. The bamboos supply many of the wants of the natives of trop. countries.

*Classification and chief genera* (after Hackel): the G. show near relationship only to *Cyperaceae* and perhaps *Juncaceae*, and are easily distinguished from these either by their vegetative or floral characters.

- A. Spikelets 1-flowered without elongation of the axis beyond the flr., or 2-flowered with the lower flr. imperfect; without measurable internode between the individual glumes or paleae, and when ripe falling off from the stalk as a whole or together with certain parts of the axis of the spike.
  - a. Hilum point-like; spikelets not compressed laterally, but usually dorsally compressed or cylindrical.
  - I. *Maydaceae* (inf. palea and, when present, sup. palea thin and membranous; glumes firm, even leathery or cartilaginous, the lowest one the largest and overlapping the rest; spike-

- lets usually in racemes or spikes which become jointed when ripe; ♂ and ♀ spikelets in separate infls. or in separate parts of the same infl.): *Euchlaena*, *Zea*, *Coix*.
- II. *Andropogoneae* (as I, but spikelets ♀, or ♂ and ♀ side by side in the same infl.): *Saccharum*, *Andropogon*, *Sorghum*.
- III. *Zoysieae* (paleae membranous; glumes herbaceous, papery or leathery, the lowest usually the largest; spikelets falling singly or in groups from an unjointed spike-axis): *Zoysia*.
- IV. *Tristegineae* (paleae membranous; glumes herbaceous or firm and papery, the lowest smaller or narrower than the rest; spikelets falling singly from the twigs of a panicle): *Arundinella*.
- V. *Panicaceae* (paleae usually cartilaginous, leathery or papery; glumes more delicate, usually herbaceous, the lowest usually smaller; spikelets falling singly from the twigs of a panicle or unjointed spike-axis): *Paspalum*, †*Panicum*, †*Setaria*, *Cenchrus*, *Pennisetum*, *Spinifex*.
- b. Hilum linear; spikelets laterally compressed.
- VI. *Oryzeae*: *Zizania*, *Oryza*, *Lygeum*, †*Leersia*.
- B. Spikelets 1—many-flowered; when 1-flowered often with a prolongation of the axis above the flr., their stalks usually jointed above the glumes, so that they fall off leaving these on the axis; when 2- or more-flowered, always with distinct internodes between the flrs.
- a. Stem herbaceous, annual. No petiole, or joint between blade and sheath.
- VII. *Phalarideae* (spikelets in panicles, spikelike panicles or racemes, on distinct stalks—sometimes very short, not set in notches on the main axis; 1-flowered, with 4 glumes and 1-nerved sup. palea): †*Phalaris*, †*Anthoxanthum*, †*Hierochloa*.
- VIII. *Agrostideae* (as VII, but spikelets with two or no glumes and 2-nerved sup. palea): *Aristida*, *Stipa*, †*Milium*, †*Phleum*, †*Alopecurus*, †*Mibora*, *Sporobolus*, †*Poly-pogon*, †*Agrostis*, †*Gastridium*, †*Calamagrostis*, †*Amphipha*, †*Apera*, †*Lagurus*.
- IX. *Aveneae* (infl. as VII, but spikelets 2—many-flowered; inf. paleae usually shorter than glumes, with twisted awn upon the dorsal side, more rarely with no awn or with an awn upon the tip as X, but then always with 2 almost opp. flrs. and no prolongation of the axis beyond them): †*Holcus*, †*Aira*, †*Corynephorus*, †*Deschampsia*, †*Trisetum*, †*Avena*, †*Arrhenatherum*, *Danthonia*.
- X. *Festuceae* (as IX, but inf. palea usually longer than glume, without awn or with untwisted awn at tip): †*Sesleria*,

Gynerium, Arundo, †Phragmites, †Triodia, †Molinia, Eragrostis, †Koeleria, †Catabrosa, †Melica, †Briza, †Dactylis, †Cynosurus, †Poa, †Glyceria, †Festuca, †Bromus, †Brachypodium.

XI. *Chlorideae* (spikelets in 2 rows approximated to one another, forming a one-sided spike or raceme with unjointed axis): †Cynodon, †Spartina, Chloris, Bouteloua, Eleusine.

XII. *Hordeae* (spikelets in 2, or rarely more, opp. rows, forming a symmetrical, rarely one-sided, spike): †Nardus, †Lolium, †Lepturus, †Agropyrum, Secale, Triticum, †Hordeum, †Elymus.

b. Stem woody, at least below; leaf often petiolate, finally separating from its sheath by a joint.

XIII. *Bambuseae*: Arundinaria, Bambusa, Dendrocalamus.

The genera marked with a dagger (†) are those of the British flora. Many are rare and unimportant. Space will not permit of giving a key to the genera; the student should work through the commoner ones with a flora, or Hutchinson's *British Grasses*. [G. are placed in Glumaceae by Benth.-Hooker, in *Glumiflorae* by Eichler and Warming.]

**Grammanthes** DC. Crassulaceae. 1 sp. Cape Col.

**Gratiola** (Rupp.) Linn. Scrophulariaceae (II. 8). 24 sp. cosmop. Sta. 2. The dried plant of *G. officinalis* L. was formerly official.

**Grevillea** R. Br. Proteaceae (II). 160 sp. Austr. Trees and shrubs with leaves of various kinds and racemose infls., with 2 fls. in each axil. The style projects from the bud as a long loop, the stigma being held by the perianth until the pollen is shed upon it. Then the style straightens out, and the pollen may be removed by visiting insects, the stigma not being yet receptive; presently the female stage supervenes, and if all the pollen has not been removed, autogamy may occur. Some sp. yield useful timber.

**Grewia** Linn. Tiliaceae. 90 sp. As., Afr., Austr., esp. trop.

**Grindelia** Willd. Compositae (III). 25 sp. Am.

**Griselinia** Forst. f. Cornaceae. 2 sp. N. Z.

**Griselinia** Scop. = Pterocarpus Linn.

**Gronovia** Houst. ex Linn. Loasaceae (I). 2 sp. trop. Am. Sta. 5, and no staminodes. Cpl. 1.

**Grossularia** Tourn. ex Adans. = Ribes Linn.

**Grubbia** Berg. Grubbiaceae (the only genus). 3 sp. Cape Col.

**Grubbiaceae**. Dicotyledons (Archichl. Santalales). Only genus Grubbia. United to Santalaceae by Benth.-Hooker. [See *Nat. Pfl.*]

**Guaiacum** Plum. ex Linn. Zygophyllaceae. 4 sp. N. and trop. Am.

*G. officinale* L. yields the valuable lignum-vitae wood, from which is also obtained the medicinal resin guaiacum.

**Guatteria** Ruiz et Pav. Anonaceae (2). 50 sp. trop. Am.

**Guettarda** Linn. Rubiaceae (II. 12). 40 sp. trop., all but one in Am.

**Gullandina** Linn. = *Caesalpinia* Linn.

**Guilleminia** H. B. et K. Amarantaceae (3). 3 sp. Am.

**Guizotia** Cass. Compositae (v). 5 sp. Afr. *G. abyssinica* Cass. is cultivated for its oily seeds, from which Rantil oil is expressed.

**Gunnera** Linn. Haloragidaceae. 17 sp. S. Am., N. Z., Tasm., Sandw. Is., Java, S. Afr., Costa Rica. Several sp. are enormous herbs with very handsome leaves several feet across. They grow by the side of water and deserve more attention as ornamental plants than they have hitherto received. Flr. 2-merous. Ovary 1 loc. Stem polystelic. In the leaf-axils are 'squamae intravaginales' (cf. Potamogetonaceae). [See Jonas' Inaug. Diss., abstr. in *Beihfte z. Bot. Cent* 1894, p. 32]

**Gurania** Cogn. Cucurbitaceae (II) 49 sp. trop. Am

**Gustavia** Linn. (*Japarandiba* Adans.) Icythidaceae. 20 sp. trop. Am. *G. augusta* L. is the stink-wood, the wood has a foetid smell.

**Gutierrezia** Lag. Compositae (III). 20 sp. Am

**Guttiferae**. Dicotyledons (Archichl. Parietales). 42 gen. with 450 sp. chiefly trop. As defined by Engler, the order includes the Hypericaceae of Bentham and Hooker (and other authors) as well as a few of the Ternstroemiaceae. They are (exc. *Hypericum*) trees or shrubs with simple entire opp. exstip. leaves. Oil glands or passages are always present, often showing as translucent dots upon the leaves. The infl. is cymose, frequently umbellate. The flrs. show considerable variety in structure. The bracteoles are frequently close up to the calyx, and hardly to be distinguished from it. The axis is usually convex, but exhibits many forms. The flr. may be cyclic or partly spiral, and is usually regular,  $\bar{\sigma}$ , hypogynous. Calyx imbricate. Corolla imbricate or convolute. Sta.  $\infty$ , free or united in various ways, frequently in bundles (usually regarded as due to branching of originally simple papillae), very commonly the outer ones or even all of the sta. are staminodial.  $\underline{G}$  usually (5) or (3), multi- or 1-loc., ovules  $\infty$ , few, or 1, anatropous; styles free or united. Fruit often capsular, sometimes a berry or drupe. Seed exalbuminous. [For details of the great variety in floral structure, see Engler in *Nat. Pfl.*] Many yield useful timber, the resins of *Clusia*, *Garcinia*, *Calophyllum*, &c., and the fruits of *Garcinia* and others are valuable.

*Classification and chief genera* (after Engler). The G. are closely allied to Theaceae, the only constant distinction being the presence of oil-glands, and to Dipterocarpaceae, which are chiefly distinguished by their alt. stip. leaves. The characters of the sub-orders would occupy too much space, and we give therefore only those of the Hypericoideae, which are often made into an independent order.

I. *KIEI MEYEROIDEAE*: *Kielmeyera*, *Caraipa*.

II. *HYPERICOIDEAE* (leaves opp.; flr.  $\bar{\sigma}$ ; sta. usually  $\infty$ , usually in 5 or 3-8 bundles before the petals; styles 3-5,



usually free; fruit a 1- or 3-loc. septi- or loculi-cidal capsule, or indehiscent; embryo usually straight with not very thick cotyledons): *Hypericum*, *Vismia*.

- III. *ENDODESMIOIDEAE* (placed in Hypericaceae by Benth.-Hooker; sta. united into a tube above, in 5 bundles below; cpl. 1; drupe; cotyledons fleshy): *Endodesmia* (only genus).  
 IV. *CALOPHYLLOIDEAE*: *Mesua*, *Mammea*, *Calophyllum*.  
 V. *CLUSIOIDEAE*: *Clusia*, *Garcinia*.  
 VI. *MORONOBOIDEAE*: *Symphonia*.

[Placed in Guttiferales by Benth.-Hooker, in Cistiflorae by Warming.]

**Guzmania** Ruiz et Pav. Bromeliaceae (4). 5 sp. trop. S. Am. Epiphytes.

**Gymnadenia** R. Br. = *Habenaria* Willd. (spec. names mostly the same).

**Gymnema** R. Br. Asclepiadaceae (II. 4). 25 sp. W. Afr. to Austr.

The leaves of *G. sylvestre* R. Br. contain gymnemic acid, and when chewed temporarily destroy the capacity of tasting sugar.

**Gymnocladus** Lam. Leguminosae (II. 7). 2 sp. China and N. Am.

**Gymnogramme** Desv. Polypodiaceae. 90 sp., esp. trop. *G. leptophylla* Desv., an annual fern, occurs in Jersey.

**Gymnospermae.** One of the two great divisions of Spermatophyta or seed-plants. They are distinguished from the Angiospermae by the fact that the cpls. are not so infolded or united as to form an ovary round the ovules; also the endosperm (female prothallus) is formed before fertilisation. The existing G. are divided into three great classes, Cycads, Conifers, and Gnetaceae. These differ very much from one another and appear to have been derived from separate stocks of Pteridophyta. The Cycads perhaps have their nearest allies in the Marattiaceae, the Conifers in the Lycopodiaceae, whilst the position of the Gnetaceae is peculiar and in some ways nearer to the Angiosperms. The flrs. in most Cycads and Conifers take the form of cones; whether each cone represents one flr. or one infl. is a disputed point (see p. 56, and art. Coniferae). The sta. is of simple structure; in the Cycads there are several pollen-sacs, looking just like the sporangia of Marattiaceae, upon the lower side of a somewhat leaf-like organ; in the Conifers the sta. has usually fewer pollen-sacs and is more leaf-like, while in the Gnetaceae the anthers are sessile. The ovules are always naked in the sense of not being enclosed in an ovary formed of one or more hollow cpls., but they are usually protected in some way from the weather. Wind-pollination occurs.

In the Cycads a considerable mass of sporogenous tissue is formed in the ovule (mega-sporangium): one of the cells of this tissue gives rise to the embryo-sac (mega-spore). This behaviour is closely comparable to that of the higher Pteridophyta. In the embryo-sac the female prothallus (endosperm) forms by cell-division, and archegonia

in which the ova are contained develop at the micropylar end. The ovule is now mature and consists of an integument, nucellus, and embryo-sac and its contents.

In most Conifers the sporogenous tissue consists only of the cell which goes to form the embryo-sac. In the sac the same process goes on as in Cycads.

In Ephedra the phenomena are very similar to those in Conifers; in Gnetum several embryo-sacs are formed, and the division of the nucleus of the sac gives rise, not to a prothallus as in the cases above described, but to a number of free nuclei lying on the wall of the sac. The male nucleus fuses with one of these and the rest then give rise to the endosperm. Here we have an intermediate phase between Conifers or Cycads and Angiosperms, more especially some of the Chalazogamæ (q. v.).

The whole question of the relationships of the Gymnosperms is one of much difficulty. That they are offshoots from the main line of the evolution of higher plants we have seen reason to believe (p. 130), but their relationships to one another and to the Pteridophyta are still almost unknown. [See Angiospermae, Chalazogamæ, Pteridophyta, Cycadaceæ, Coniferae, Gnetaceæ, and refer also to Chap. I., and to Campbell's *Mosses and Ferns*, Nawaschin in *Mém. de l'Acad. des sc. de St. Pétersbourg*, XLII. 1894 (reviewed in *Bot. Cent.* 62, p. 324) and other papers referred to under Chalazogamæ.]

**Gymnosporia** Benth. et Hook. f. Celastraceæ. 60 sp. trop. and sub-trop., esp. Afr. Many have branches modified into thorns.

**Gynandropsis** DC. (*Pedicularia* Schrank). Capparidaceæ (1). 15 sp. trop. The seeds of *G. pentaphylla* DC. are used like mustard.

**Gynerium** Humb. et Bonpl. Gramineæ (λ). 3 sp. trop. and warm temp. *G. argenteum* Nees is the Pampas grass, often cultivated as a show plant. It is dioecious.

**Gypsophila** Linn. Caryophyllaceæ (1. 2). 50 sp. Eur., As., esp. in E. Medit. region. The fls. are shorter in the tube than those of most Silenoideæ, and are in consequence visited by a greater variety of insects.

**Habenaria** Willd. (incl. *Bonatea* Willd., *Coeloglossum* Hartm., *Gymnadenia* R. Br., *Neotinea* Rehb. f., *Nigritella* Rich., *Platanthera* Rich., and other gen. often regarded as separate, e.g. by Pfitzer in *Nat. Pfl.*) Orchidaceæ (3). 400 sp. temp. and trop.; 5 in Brit., *H. (C.) viridis* R. Br. (frog-orchis), *H. (G.) conopsea* Benth. (scented orchis), *H. (P.) bifolia* R. Br. (butterfly orchis), &c. See Darwin's *Orchids*.

**Hablitia** Bieb. Chenopodiaceæ (2). 1 sp. Caucasus. A climbing shoot is given off each year from the perennial underground stem (cf. *Bowica*).

**Habrothamnus** Endl. = *Cestrum* Linn.

**Hacquetia** Neck. Umbelliferae (3). 1 sp. S. Eur.

**Haemanthus** (Tourn.) Linn. Amaryllidaceae (1). 60 sp. S. Afr. Flrs. in cymose heads or umbels.

**Haematoxylon** Linn. Leguminosae (11. 7). 1 sp. trop. Am. *H. cam-  
pechianum* L., the logwood. The young foliage is red (p. 199). In  
the leaf-axils are thorns. The heart-wood contains the dye-stuff  
haematoxylin and is largely used in dyeing; it is broken into chips  
before use.

**Haemodorum** Sm. Monocotyledons (Liliiflorae). 9 gen. with 33 sp.,  
Austr., S. Afr., trop. Am. Herbs with paniced infl., consisting of  
a number of cymes arranged in a racemose way (cf. *Aesculus*). Flr.  
regular or transversely zygomorphic (cf. *Anigozanthos*), 3-merous.  
Sta. 3, inserted on inner perianth-leaves, with introrse anthers.  
G (3), sup. or inf.; ovules few in each loc., semi-anatropous. Stigma  
capitate. Capsule. *Chief genera*: *Haemanthus*, *Lachnanthes*, *Wach-  
endorfia*. [As defined by Benth.-Hooker, the order includes sub-  
orders VIII, IX of Liliaceae, and part of sub-order III of Amaryllidaceae  
(*Anigozanthos*, &c.). It is placed in Epigynae by Benth.-Hooker,  
in Liliiflorae by Warming.]

**Haemodorum** Sm. Haemodoraceae. 17 sp. Austr.

**Hakea** Schrad. Proteaceae (11). 100 sp. Austr. Xerophytes with  
hard woody fruit. The seedlings show interesting transition stages  
(p. 113, and cf. *Acacia*) from entire leaves to the much divided leaves  
usually seen in the genus.

**Halenia** Borkh. Gentianaceae (1. 3). 25 sp. As., Am.; alpine and  
arctic.

**Halesia** Linn. Styracaceae. 7 sp. Japan, China, and S. E. of N. Am.  
(cf. *Epigaea*, &c.). The Snowdrop-tree. Fruit winged.

**Halimocnemis** C. A. Mey. Chenopodiaceae (10). 10 sp. Cent.  
As.

**Halimodendron** Fisch. Leguminosae (11. 6). 1 sp. N. and W. As.  
on salt-steppes. The outer leaflets are often thorny (p. 183).

**Halleria** Linn. Scrophulariaceae (11. 6). 8 sp. Afr., Madag.

**Haloragidaceae**. Dicotyledons (Archichl. Myrtiflorae). 8 gen. with  
90 sp., cosmop., but chiefly Austr. Land, marsh, or water plants,  
herbaceous, of very various habit (see gen.), and with inconspicuous  
flrs., solitary or in infl. The anatomy of the water forms is of interest,  
and also that of *Gunnera*, whose stem is polystelic. Flr. 3 or uni-  
sexual, usually bracteolate, regular, epigynous, usually 4-merous.  
Perianth in two whorls, or one, or absent. Sta. 8, obdiplostemonous,  
or fewer (down to 1 in *Hippuris*). Cpls. (1-4); ovary inf., multi-  
loc., with usually 1 pendulous anatropous ovule in each loc.; styles  
free. Nut or drupe. Embryo straight, in endosperm. *Chief genera*:  
*Haloragis*, *Myriophyllum*, *Gunnera*, *Hippuris*. The H. are undoubt-  
edly related to *Onagraceae*, as reduced forms. A gradual series may  
be traced, from the very complete flr. of *Myriophyllum* or *Haloragis*,  
down to that of *Hippuris*. Eichler and Warming also place the order

in Myrtiflorae, whilst Benth.-Hooker add to it the Callitrichaceae and place it in Rosales.

**Halorageae** (Benth.-Hooker) = Haloragidaceae.

**Haloragis** Forst. Haloragidaceae. 50 sp. Austr., N. Z., Tasm., S. E. As., N. Am. Large herbs living in damp places. Flrs. 4-merous throughout, obdiplostemonous.

**Haloxylon** Bunge. Chenopodiaceae (10). 10 sp. N. temp. and sub-trop. Steppe plants of curious habit (fig. in *Nat. Pfl.*).

**Hamamelidaceae.** Dicotyledons (Archichl. Rosales). 18 gen. with 50 sp. chiefly sub-trop. (N. and S.). The distribution areas of the genera (q.v.) are extremely disjointed, a fact probably due to the influence of the glacial period (p. 157 and *Nat. Pfl.*). They are closely allied to Cunoniaceae, and hence to Saxifragaceae. Trees and shrubs with alt., simple or palmate, stip. leaves. Infl. racemose, often a spike or head, frequently with an involucre of coloured bracts. Flr. ♂ or unisexual, often apetalous, rarely naked, hypo- peri- or epigynous, usually without a disc. K 4—5, usually imbricate; C 4—5, open or valvate, the petals often long and rolled up like a watch-spring in bud; A 4—5 or rarely fewer; G (2), usually median, rarely obliquely placed, with 2 styles, 2-loc.; ovules 1 or more in each loc., pendulous, anatropous, with ventral or lateral raphe. Loculicidal or septicial capsule. Exocarp woody, endocarp horny. Seed albuminous, with straight embryo. Some sp. yield useful wood, resins, &c. *Chief genera*: Bucklandia, Liquidambar, Altingia, Fothergilla, Hamamelis. [Placed in Saxifraginae by Warming, in Rosales by Benth.-Hooker.]

**Hamamelideae** (Benth.-Hooker) = Hamamelidaceae.

**Hamamelis** Gronov. ex Linn. Hamamelidaceae. 3 sp., two in China and Japan, the other, *H. virginiana* L., the witch-hazel, in east N. Am. This sp. is common in gardens. It flowers in late autumn and ripens its fruit (which is said to be explosive) in the following year.

**Hanburia** Seem. Cucurbitaceae (14). 1 sp. Mexico. Fruit explosive.

**Haplopappus** Endl. = Aplopappus Cass.

**Hardenbergia** Benth. Leguminosae (III. 10). 3 sp. Austr. Included in Kennedya in *Nat. Pfl.*

**Harpagophytum** DC. Pedaliaceae. 3 sp. S. Afr. *H. procumbens* DC. is the grapple-plant; its fruit is beset with large woody grapples about an inch long, pointed and barbed. It is thus well adapted to animal distribution, and is troublesome to wool growers (cf. Xanthium).

**Hartwegia** Lindl. Orchidaceae (13). 2 sp. Cent. Am.

**Hauya** (Moç. et Sesse) ex DC. Onagraceae (III). 4 sp. Mexico, Calif.

**Haworthia** Duval. Liliaceae (III). 100 sp. S. Afr. Xerophytes with fleshy leaves, similar in habit to Crassulaceae.

**Hebenstretia** Linn. Scrophulariaceae (II. 9). 20 sp. S. Afr. The

corolla is slit open along the anterior side, and the style and sta. project through the slit. [Selagineae Benth.-Hooker.]

**Hedeoma** Pers. Labiatae (vi. 11). 12 sp. Am.

**Hedera** Tourn. Araliaceae. 3 sp. temp. Old World. *H. Helix* L. is the ivy. It is a root climber on trees and rocks. The leaves are dimorphic, those on the climbing shoots being lobed, whilst those on the freely projecting shoots that bear the infl. are not. The former form leaf-mosaics better (see pp. 37 and 177). The flrs. are not very conspicuous, but coming out late in the year are largely visited for the freely exposed honey by flies and wasps.

**Hedraeanthus** Griseb. = *Wahlenbergia* Schrad. (11 sp. S.E. Eur., W. As.)

**Hedwigia** Sw. Burseraceae. 3 sp. trop. Am. *H. balsamifera* Sw. (Antilles) is known as pig's balsam, on account of a legend that wounded pigs rub themselves against the trees to heal their wounds with the resin.

**Hedycapnos** Planch. = *Dicentra* Bernh.

**Hedycaria** Forst. Monimiaceae. 10 sp. Austr. to Fiji.

**Hedychium** Koen. Zingiberaceae. About 30 sp. chiefly trop. As. The rhizome is often tuberous. The flr. has a long tube, at the end of which spring the very narrow free parts of the petals and the larger staminodes and labellum. The stigma projects just beyond the anther. According to F. Müller and others the flr. is adapted for fertilisation by the wings of butterflies.

**Hedyotis** Linn. Rubiaceae (t. 2). About 120 sp. trop. Incl. in *Oldenlandia* in *Nat. Pl.*

**Hedypnois** Schreb. = *Rhagadiolus* Tourn.

**Hedypnois** (Tourn.) Scop. = *Leontodon* Linn.

**Hedysarum** (Tourn.) Linn. Leguminosae (III. 7). 60 sp. N. temp.

**Heeria** Schlecht. (*Heterocentron* Hook. et Arn.) Melastomaceae (1). 6 sp. Cent. Am. Some of the sta. attract insects, the others pollinate them (cf. *Commelina*).

**Helenium** Linn. Compositae (vi). 30 sp. W. Am.

**Heleocharis** Lestib. = *Eleocharis* R. Br.

**Heliamphora** Benth. Sarraceniaceae. 1 sp. Guiana, a pitcher plant (p. 195 and cf. *Sarracenia*), not yet thoroughly studied.

**Helianthemum** Tourn. ex Hall. Cistaceae. 120 sp. Eur., Medit., N. Am. *H. vulgare* Gaertn. and 3 others in Brit. (rock-rose). Infl. a cincinnus. The flr. contains no honey and is homogamous, with sensitive sta., which move outwards when touched.

**Helianthus** Linn. Compositae (v). 55 sp. Am. Several sp. are widely cultivated. *H. annuus* L. is the sunflower; the number of flrs. upon the head is often enormous and they show very regular spiral arrangement, probably due (largely) to pressure in the bud. The ray florets are neuter. *H. tuberosus* L. is the Jerusalem artichoke. It has sub-

terranean tuberous stems, like potatoes, with well marked 'eyes' (buds in axils of scale-leaves).

**Helichrysum** Vaill. ex Linn. Compositae (IV). 300 sp. Eur., As., Afr., Austr. About 150 occur in S. Afr. Many are xerophytes with hairy surface, decurrent leaves, &c. The dried flower-heads of some sp. are sold as 'everlastings.'

**Hellicodiceros** Schott. Araceae (VII). 1 sp. Corsica, Sardinia, *H. crinitus* Schott (*H. muscivorus* Engl.). The development of the pedate leaf is cymose; the later formed branches grow more slowly than the earlier. The specific name *muscivorus* is due to the number of flies captured; they are attracted by the foul smell of the infl. (cf. Arum) and collect inside the spathe in enormous numbers (in the Bot. Gdn. Cambridge, the whole spathe may often be seen tightly packed with them); when it withers the top closes and they are caught.

**Heliconia** Linn. Musaceae. 30 sp. trop. Am. Flrs. in cincinni. The odd sepal is posterior.

**Helicteres** Pluk. ex Linn. Sterculiaceae. 40 sp. trop. (exc. Afr.). The flrs. become zygomorphic if they happen to be in a horizontal position.

**Heliophila** Burm. f. ex Linn. Cruciferae (I. 3). 60 sp. S. Afr.

**Heliopsis** Pers. Compositae (V). 7 sp. Am.

**Heliotropium** (Tourn.) Linn. Boraginaceae (III). 220 sp. trop. temp. *H. peruvianum* L. (cherry pie) and other sp. of heliotrope are cultivated for their scented flrs.

**Helipterum** DC. Compositae (IV). 48 sp. Austr., S. Afr. Xerophytes with persistent involucre of white scaly bracts; the dried flower-heads are sold as 'everlastings' (cf. *Helichrysum*, &c.).

**Helleborus** (Tourn.) Linn. Ranunculaceae (2). 15 sp. Eur.; 2 in Brit. (*Hellebore*). The plants are woody below, each shoot from the stock taking several years to reach maturity and flower. Flr. protogynous, opening very early in the year. Cpls. slightly coherent at base. In *H. niger* L., the Christmas rose, the perianth turns green after the flr. has been fertilised.

**Helminthia** Juss. = *Picris* Linn.

**Helminthostachys** Kaulf. Ophioglossaceae. 1 sp. *H. zeylanica* Hk. f. Ceylon, Himal. to Queensland. It is but slightly known, as far as structure and life history are concerned. It is said that the roots do not bear the same relation to the leaves as in the other genera of O.

**Helobieae**. The 2nd cohort of Monocotyledons (1st of Warming's system). See p. 135.

**Helonias** Linn. Liliaceae (I). 1 sp. east N. Am.

**Helosciadium** Koch = *Apium* Tourn.

**Helosis** Rich. Balanophoraceae. 3 sp. trop. Am.

**Hemerocallis** Linn. Liliaceae (III). 5 sp. temp. Eur., As. Infl. a double bostryx. The flrs. of *H. fulva* L. are self-sterile.

**Hemionitis** Linn. Polypodiaceae. 8 sp. trop.

- Hemitelia** Br. Cyatheaceae. About 20 sp. trop. and S. temp. Tree-ferns.
- Hemizonia** DC. Compositae (v). 25 sp. west N. Am.
- Hepatica** Dill. = *Anemone* Linn.
- Heptapleurum** Gaertn. Araliaceae. About 50 sp. trop. Afr., As., Austr. Included in *Schefflera* in *Nat. Pfl.*
- Heracleum** Linn. Umbelliferae (7). 70 sp. N. temp., and trop. Mts. (*H. Sphondylium* L., cow-parsnip, in Brit.).
- Herbertia** Sweet (*Alophia* Herb.). Iridaceae (II). 3 sp. trop. and sub-trop. Am.
- Heritiera** (Dryand.) Ait. Sterculiaceae. 4 sp. trop. Old World, on sea coasts.
- Hermannia** Linn. (excl. *Mahernia* Linn.). Sterculiaceae. 120 sp. trop. and sub-trop., chiefly Afr.
- Herminiera** Guill. et Perr. Leguminosae (III. 7). 1 sp. trop. Afr., *H. elaphroxylon* G. et P. The wood is as light as elder pith and is used for floats, canoes, &c. This phenomenon seems to be related to the development of aerenchyma seen in other marsh plants (cf. *Lycopus*, Jussieu, &c., and see p. 172). *H.* is united to *Aeschynomene* in *Nat. Pfl.*
- Herminium** Linn. Orchidaceae (3). 4 sp. temp. Eur., As. (*H. Monorchis* R. Br., musk-orchis, in Brit.). Flr. like that of orchis, but smaller, and fertilised by small flies which get the pollinia stuck to their legs.
- Hernandia** Plum. ex Linn. Hernandiaceae. 8 sp. trop. (Laurineae Benth.-Hooker).
- Hernandiaceae**. Dicotyledons (Archichl. Ranales). 4 gen. with 24 sp. trop. Like Lauraceae, to which they are united by Benth.-Hooker and Warming, but with epigynous flr. Ovary inf., 1-loc., with 1 pendulous anatropous ovule. See *Nat. Pfl.* for details.
- Herniaria** (Tourn.) Linn. Caryophyllaceae (II. 4). 15 sp. Medit., Eur., S. Afr. (*H. glabra* L., rupture-wort, in S. W. England.) Flr. apetalous.
- Herpestis** Gaertn. (*Bacopa* Aubl.) Scrophulariaceae (II. 8). 50 sp. trop. and sub-trop., chiefly Am.
- Hesperantha** Ker-Gawl. Iridaceae (III). 20 sp. S. Afr.
- Hesperis** Linn. Cruciferae (IV. 19). 24 sp. Eur., Medit.; (1 Brit.).
- Heteranthera** Ruiz et Pav. Pontederiaceae. 10 sp. trop. and sub-trop. Am., Afr. Leaves of two types—linear submerged and orbicular floating. Some have cleistogamic flrs.
- Heterocentron** Hook. et Arn. = *Heeria* Schlecht.
- Heteromerae** (Benth.-Hooker). The 2nd series of Gamopetalae (p. 143).
- Heteropteris** H. B. et K. Malpighiaceae (I). 90 sp. trop. Am., 1 in trop. Afr. Fruit a samara (cf. *Acer*, *Banisteria*).
- Heterotoma** Zucc. Campanulaceae (III). 4 sp. Mexico.

- Heterotropa** Morr. et Dcne. = *Asarum* Linn.
- Heuchera** Linn. Saxifragaceae (1). 24 sp. N. Am. Flrs. sometimes apetalous.
- Hevea** Aubl. Euphorbiaceae (A. 11. 3). 10 sp. trop. Am. *H. brasiliensis* Müll.-Arg. is the source of the best caoutchouc (Para rubber); incisions are made in the bark, and the latex flows out and coagulates. Other sp. are also used for rubber-making, as well as other genera (see Index).
- Hexaptera** Hook. Cruciferae (1. 2). 6 sp. temp. S. Am. Fruit winged.
- Hibbertia** Andr. (incl. *Candollea* Labill. 1806). Dilleniaceae. 100 sp. Austr., New Caled. &c. Mostly shrubs of ericoid or climbing habit. Some sp. have phylloclades. Infl. dichasial, but often, by reduction, coming to look like a raceme. The sta. &c. vary much in number in different sp. (see *Nat. Pfl.*).
- Hibiscus** Linn. (incl. *Abelmoschus* Medic.). Malvaceae (1v). 150 sp. trop. and sub-trop. The 5 ante-sepalous sta. are represented by teeth at the top of the stamen-tube. Several sp. are cultivated, especially *H. Rosa-sinensis* L.
- Hieracium** (Tourn.) Linn. Compositae (XIII). 400 sp. N. Hemisph., S. Afr., Andes. There are several sp. in Brit. (hawk-weeds), which, especially in Scotland, vary very much; innumerable varieties have been raised by various botanists to specific rank (see p. 123 and *London Cat. of Brit. Plants*, 9th ed.).
- Hierochloa** S. G. Gmel. Gramineae (VII). 13 sp. temp. and frigid. (1 Brit., rare.)
- Higginsia** Pers. = *Hoffmannia* Sw.
- Hildebrandtia** Vatke. Convolvulaceae (1. 3). 2 sp. Afr.
- Himantoglossum** Spreng. = *Orchis* Tourn.
- Hinterhubera** Sch. Bip. Compositae (III). 3 sp. Andes.
- Hippeastrum** Herb. Amaryllidaceae (1). 50 sp. trop. and sub-trop. Am.
- Hippia** Linn. Compositae (VII). 4 sp. S. Afr.
- Hippocastanaceae**. Dicotyledons (Archichl. Sapindales). Only genus *Aesculus* (q.v.). United to Sapindaceae by Benth.-Hooker.
- Hippocratea** Linn. Hippocrateaceae. 70 sp. trop. Twining shrubs.
- Hippocrateaceae**. Dicotyledons (Archichl. Sapindales). 3 gen. with 150 sp. trop. and sub-trop. Shrubs, mostly lianes, with opp. or alt. simple leaves. Flrs. in cymes, ♂, regular, with disc. K 5, C 5, A 3 (rarely 5, 4, 2),  $\bar{G}$  (3), with 2-10 anatropous ovules in each loc. Berry or schizocarp. No endosperm. *Genera*: *Campylostemon*, *Hippocratea*, *Salacia*. [United to Celastraceae by Benth.-Hooker; placed in Frangulinae by Warming.]
- Hippocrepis** Linn. Leguminosae (III. 7). 12 sp. Medit. *H. comosa* L. extends to Scotland. The mechanism of the flr. is like that of *Lotus*, but on the claw of the standard is a triangular flap closing the entrance to the honey. Bees must lift the standard to reach the honey and so cannot avoid making the mechanism work properly.



- Hippomane** Linn. Euphorbiaceae (A. II. 7). 1 sp. Cent. Am., W. Ind., Columbia (the manchineel). The latex is highly poisonous.
- Hippophaë** Linn. Elaeagnaceae. 2 sp., one Himal., the other, *H. rhamnoides* L., the sea buckthorn, from Brit. to Altai Mts. In the ♂ flr. the bracteoles form a hood over the sta. in wet weather; when the air is drier, they separate at the sides, and the pollen may be blown away by wind.
- Hippuris** Linn. Haloragidaceae. 1 sp., *H. vulgaris* L. the mare's-tail, Eur. (incl. Brit.), As., Austr., Am. A water plant, with creeping rhizome and erect shoots, whose upper parts usually project above the water. Leaves linear, in whorls, the submerged ones longer and more flaccid than the aerial. Flr. sessile in axil of leaf, ♂ (or sometimes ♀ on some stocks; cf. Labiatae), consisting of 1 epigynous sta. and 1 cpl., with a slight seam representing the calyx; wind fertilised.
- Hiraea** Jacq. (*Mascagnia* Bert.). Malpighiaceae (I). 40 sp. trop. Am.
- Hirtella** Linn. Rosaceae (VI. 13). 40 sp. S. and Cent. Am., 1 Madag. Flr. zygomorphic. The axis is deeply hollowed on one side, but the sta. and cpl. are not in the hollow, but on the other side of the surface of the axis.
- Hodgsonia** Hook. f. et Thoms. Cucurbitaceae (III). 1 sp. Indo-mal.
- Hoffmannia** Sw. Rubiaceae (I. 8). 20 sp. trop. Am.
- Holboellia** Wall. Lardizabalaceae. 2 sp. Himal.
- Holcus** Linn. Gramineae (IX). 8 sp. Eur., N. and S. Afr. 2 in Brit., *H. mollis* L., and *H. lanatus* L., Yorkshire fog or soft-grass, a common weed, useless as fodder.
- Holosteum** Dill. ex Linn. Caryophyllaceae (II. 1). 6 sp. N. temp. (1 Brit.).
- Homalium** Jacq. Flacourtiaceae. 35 sp. trop. After fertilisation the sepals or petals, or both, grow large and form wings (often hairy) to the fruit. (Samydaceae Benth.-Hooker.)
- Homalomena** Schott. Araceae (v). 20 sp. trop. As. and S. Am.
- Homogyne** Cass. Compositae (VIII). 3 sp. Mts. of Eur.
- Honckenya** Ehrh. = *Arenaria* Rupp. (same spec. name).
- Hordeum** (Tourn.) Linn. Gramineae (XII). 16 sp. temp. Eur., As., N. Afr., Am. 4 in Brit. (barley-grass). The spikelets are arranged in groups of 3 on the main axis, forming a dense spike. Each is 1-flowered when perfect, but commonly either the central or the two lateral flrs. are aborted. Glumes awned. The cultivated barley is *H. vulgare* L. (*H. sativum* Pers.). The most common form is the var. *distichum* or 2-rowed barley, where the central flr. of each group is fertile, but 6-rowed barley (var. *hexastichum*), and 4-rowed barley or bere, are also grown. The last is the most hardy and is cultivated as far as 70° N. (in Norway).
- Horminum** (Tourn.) Linn. Labiatae (VI. 9). 1 sp. Mts. of S. Eur.
- Hosackia** Dougl. Leguminosae (III. 4). 30 sp. west N. Am.
- Hosta** Tratt. = *Funkia* Spreng.

**Hotela** C. Morr. et Dcne = *Astilbe* Buch.-Ham.

**Hottonia** Boerh. ex Linn. Primulaceae (1). 2 sp., one in N. Am., the other, *H. palustris* L. (water-violet), in Siberia and Eur. (incl. Brit.). Floating water-plants (p. 168) with finely-divided submerged leaves. The flrs. project above the water; they are dimorphic like those of *Primula*. Winter buds form as in *Utricularia*, &c.

**Houstonia** Gronov. ex Linn. Rubiaceae (1. 2). 20 sp. west N. Am. Flrs. heterostyled as in *Primula*, with similar differences in stigma and pollen.

**Houttuynia** Thunb. Saururaceae. 2 sp. N.W. Am. and E. As.

**Howea** Becc. Palmae (iv. 6). 2 sp. Lord Howe's Island.

**Hoya** R.Br. Asclepiadaceae (11. 4). 70 sp. Indo-mal., Austr. Twiners and root-climbers with fleshy leaves. Hothouse favourites on account of their handsome flrs. (wax-flowers).

**Hudsonia** Linn. Cistaceae. 3 sp. N. Am.

**Huernia** R.Br. Asclepiadaceae (11. 4). 20 sp. Cape Col. to Arabia. Like *Stapelia*, but stem 4- to 6-angled.

**Hugonia** Linn. Linaceae. 11 sp. trop. Old World. The lower twigs of the infl. are modified into hooks for climbing (p. 177).

**Humboldtia** Vahl (*Batschia* Vahl). Leguminosae (11. 3). 4 sp. Ceylon and Further Ind. *H. laurifolia* Vahl is myrmecophilous (p. 117). The non-flowering twigs are normal, but those that bear flrs. have hollow obconical internodes. In each of these, at the top, opposite the leaf, is a slit leading to the cavity which is inhabited by ants.

**Humea** Sm. Compositae (iv). 4 sp. S. Austr.

**Humiria** Jaume St. Hil. Humiriaceae. 3 sp. trop. Am.

**Humiriaceae**. Dicotyledons (Archichl. Geraniales). 3 gen. with 18 sp., trop. Am., Afr. Separated from Linaceae by the bilocular anthers and usually  $\infty$  sta. (See *Nat. Pl.*) Chief genera: *Humiria*, *Saccolottis*.

**Humulus** Linn. Moraceae (iv). 2 sp. N. temp. Perennial climbing herbs. Infl. cymose, dioecious, the  $\sigma$  a much-branched pseudo-panicle, the  $\rho$  a few-flowered pseudo-catkin with 2 flrs. in the axil of each scale. Flr. protogynous and wind fertilised. Fruit an achene. *H. Lupulus* L. is the hop, largely cultivated in Kent and elsewhere; the fruit is used in brewing, &c.

**Hunnemannia** Sweet. Papaveraceae (1). 1 sp. Mexico.

**Hura** Linn. Euphorbiaceae (A. 11. 7). 2 or 3 sp. trop. Am., of which the best known is *H. crepitans* L., the sand box tree. The fruit is as big as an orange with numerous hard woody cpls. Each, as the ripe fruit dries, tries to expand from the  $\Delta$  shape to a U shape. Presently a violent explosion occurs and the seeds are shot out, sometimes to a distance of 30 yards. The fruits used to be wired together and used as sand boxes before the era of blotting-paper.

**Hutchinsia** R. Br. Cruciferae (iv. 14). 8 sp. N. temp. (1 in Brit.)

**Hyacinthus** (Tourn.) Linn. Liliaceae (v). 30 sp. Medit., Afr. Many forms of hyacinth (derived from *H. orientalis* L.) are cultivated. [For the wild hyacinth of Brit., see Scilla.]

**Hydnophytum** Jack. Rubiaceae (II. 15). 30 sp. E. As., New Guinea, Fiji, &c. Epiphytes with ant-inhabited tubers, like *Myrmecodia* (q.v.).

**Hydnora** Thunb. Hydnoraceae. 7 sp. Afr.

**Hydnoraceae**. Dicotyledons (Archichl. Aristolochiales). 2 gen. with 7 sp., Afr., S. Am. Parasites like Rafflesiaceae. See *Nat. Pfl.* or Kerner's *Nat. Hist. of Plts.*

**Hydrangea** Gronov. ex Linn. Saxifragaceae (III). 20 sp. N. Hemisph. Shrubs with opp. leaves, some climbing. Flrs. in cymose corymbs, the outer (or in cultivated forms all the flrs.) neuter with petaloid calyx, giving conspicuousness to the infl. (cf. Compositae, Umbelliferae).

**Hydrangeaceae** (Warming) = Saxifragaceae (suborder III).

**Hydrastis** Ellis. Ranunculaceae (I). 2 sp., 1 in Japan, 1 in N. Am. (*H. canadensis* L., golden-seal). The latter is used as a tonic &c.

**Hydrocaryaceae**. Dicotyledons (Archichl. Myrtiflorae). Only genus *Trapa* (q.v.). Often placed in Onagraceae.

**Hydrocharideae** (Benth.-Hooker) = Hydrocharitaceae.

**Hydrocharis** Linn. Hydrocharitaceae. 1 sp. Eur. (incl. Brit.), As., *H. Morsus-ranae* L., the frog-bit, a rootless water plant with orbicular floating leaves. Flrs. dioecious, produced upon the surface of the water. During summer the plant multiplies much by horizontal stolons, which form new plants at the ends. In autumn large buds are formed on the stolons and drop off to spend the winter at the bottom of the pond. In spring they float up and develop into new plants.

**Hydrocharitaceae**. Monocotyledons (Helobiae). 13 gen. with about 55 sp. trop. and temp., all water plants, some marine (*Halophila*, *Enalae*, *Thalassia*). Most have ribbon-like submerged leaves, a few only have floating leaves (*Hydrocharis* &c.); some have leaves projecting above the water. In the leaf-axils are 'squamae intra-vaginales' (cf. *Potamogetonaceae*). Several buds are frequently found in one leaf-axil.

Sexes usually in different flrs., commonly on different plants. Infl. axillary, usually 1-flowered when ♀, often more than 1 if ♂, enclosed at first in a spathe of two or more (1 in *Hydrocharis* ♀) fused leaves. Flr. usually regular, 3-merous. Perianth usually in two whorls, the outer sepaloid, the inner petaloid; sta. in 1—5 whorls, the innermost often staminodial; cpls. (2—15), forming an inf. ovary, 1-loc. with parietal placentation; ovules ∞, ortho- to ana-tropous, erect to pendulous; stigmas as many as cpls. Fruit irregularly dehiscent, containing ∞ exalbuminous seeds. [Placed in *Microspermae* by Benth.-Hooker.] *Chief genera*: *Halophila*, *Elodea*, *Vallisneria*, *Stratiotes*, *Hydrocharis*.

**Hydrocleys** Rich. Butomaceae. 1 sp. Brazil, *H. nymphoides* Buchenau

(=*H. Commersonii* Rich.=*Limnocharis Humboldtii* Rich.), often cultivated; it is a water plant with a striking resemblance in habit to *Nymphaea* or *Limnanthemum*.

**Hydrocotyle** (Tourn.) Linn. Umbelliferae (1). 70 sp. trop. and temp. 1 in Brit., *H. vulgaris* L., the white-rot or pennywort, easily recognised among our native U. by its peltate leaves.

**Hydrolea** Linn. Hydrophyllaceae. 12 sp. trop. Several have axillary thorns (branches). Flr. self-fertilising (cf. *Phacelia*).

**Hydromystria** G. F. W. Mey.=*Limnobium* Rich. (*H. stolonifera* G. F. W. Mey.=*L. Boscii* Rich.).

**Hydrophyllaceae.** Dicotyledons (Sympet. Tubiflorae). 17 gen. with 170 sp., chiefly in N. Am. where some of the gen. are in vigorous development; in S. Am., trop. As., Afr., &c. a few sp. occur, apparently the remnants of formerly wide-spread gen. Herbs or undershrubs with simple or compound exstip. leaves, radical, alt. or opp. Plant usually hairy. Flrs. scattered or in cincinni like those of Boraginaceae, usually without bracteoles, ♀, regular, usually 5-merous. K (5), imbricate, the odd sepal posterior; C (5), rotate, or bell- or funnel-shaped, usually imbricate; A 5, epipetalous and alternate with petals, often with scale-like appendages at base (see below); G (2), 1—2-loc., with 1 or 2 styles. Ovules on each cpl. ∞—2, sessile or pendulous, anatropous. Fruit usually a loculicidal capsule. Embryo small, in rich endosperm. The flrs. in most investigated sp. are visited chiefly by bees; honey is secreted below the ovary and protected by the appendages of the sta., which are frequently united to the corolla, sometimes (*Hydrophyllum*) forming tubes leading down to the honey. Flr. usually protandrous. See *Phacelia*. *Chief genera:* *Hydrophyllum*, *Nemophila*, *Phacelia*, *Nama*, *Hydrolea*. [Placed in Polemoniales by Benth.-Hooker, in Tubiflorae by Warming.]

**Hydrophyllum** Linn. Hydrophyllaceae. 6 sp. N. Am. Flr. protandrous, with the staminal appendages united to the corolla so as to form tubes through which alone the honey is accessible.

**Hydrophyrum** Link=*Zizania* Gronov.

**Hygrophila** R. Br. Acanthaceae (IV. B). 30 sp. trop., in marshes.

**Hymenaea** Linn. Leguminosae (II. 3). 8 sp. trop. Am. *H. Courbaril* L. is the West Indian Locust tree, a large tree with buttress roots (p. 24). The wood is valuable. From the stem exudes a resin (copal or anime) which is often found in lumps underground near the trees (cf. *Agathis*, *Trachylobium*); it is used in varnish, &c.

**Hymenocallis** Salisb. Amaryllidaceae (1). 30 sp. trop. Am. The stipular appendages of the sta. are here united into a tube, on the summit of which the filaments stand, and which surpasses the perianth in conspicuousness (cf. *Eucharis*).

**Hymenopappus** L'Hérit. Compositae (VI). 11 sp. N. Am.

**Hymenophyllaceae.** Filicineae Leptosporangiatæ (Homosporous).

3 gen. with 200 sp. trop. and temp. The filmy ferns are found chiefly in damp woods. Stem very slender, often creeping; sometimes it bears roots, in other cases only root hairs. It grows more rapidly than the leaves, so that its leafless tip appears naked like a root. Leaves pinnate, filmy in texture (being only one cell thick, except at the veins), with no stomata. The placenta is at the leaf-edge, a continuation of the vein; it bears sporangia and is surrounded by a cup-shaped indusium. Sporangia sessile, with oblique or transverse complete annulus, and opening by a longitudinal fissure. The prothalli are capable of long life; in some sp. they produce *gemmae* or buds on the margin, and may thus multiply vegetatively to a considerable extent. *Chief genera:* Hymenophyllum, Trichomanes.

**Hymenophyllum** Linn. Hymenophyllaceae. Over 80 sp. trop. and temp. 2 in Brit. (filmy ferns), *H. tunbridgense* Sm. and *H. Wilsoni* Hook, moss-like plants growing in damp, shady places.

**Hymenophyssa** C. A. Mey. Cruciferae; position in the order doubtful. 2 sp. Cent. As. See *Nat. Pfl.*

**Hyophorbe** Gaertn. Palmae (iv. 6). 3 sp. Mascarenes.

**Hyoscyamus** (Tourn.) Linn. Solanaceae (II. 3). 11 sp. N. Afr., Eur., As. *H. niger* L. (henbane) is found in Brit., but probably is only an escape, it having formerly been largely cultivated as a narcotic. The flrs. are in cincinni. The capsule stands erect enclosed in the calyx, and opens by a lid; the seeds can thus only escape in strong winds, &c.

**Hyoseris** Linn. Compositae (XIII). 3 sp. Medit.

**Hypocoum** Tourn. ex Linn. Papaveraceae (I). 12 sp. Medit., Cent. As. Flr. 2-merous throughout. The inner petals are 3-sect., and the middle lobe stands erect and encloses the sta. Eichler (*Blüthendiag.*) and others regard the andrœceum as derived from the Fumaria type by union in pairs of the lateral branches of the outer whorl of sta., so as to form an apparent inner whorl of sta., but it is quite probable that the 2 inner sta. are really a true inner whorl. As in other cases, the evidence cuts both ways, and may be used as proof of the derivation of the Fumaria type from Hypocoum by splitting of the two inner sta. and the union of the halves to the outer ones. In *H. procumbens* L. the pollen is shed in the bud into pockets on the inner surface of the inner petals, which close up before the stigma develops. When pressed by an insect the pockets open and dust it with pollen. The stigma only ripens after it has grown above the level of the pollen.

**Hypericaceae** (Warming: Cistiflorae) = Hypericineae (Benth.-Hooker: Guttiferales). Chief genus Hypericum; merged in Guttiferae (q.v.).

**Hypericum** Tourn. ex Linn. Guttiferae (II). 200 sp. temp. (11 Brit., St John's wort, tutsan, &c.). They are nearly all perennial herbs with opp., often gland-dotted leaves and cymes of flrs., often forming pseudoracemes or umbels. Sta.  $\infty$ , but united into 3 or 5 groups. Developmental study shows that each of these groups arises as a simple papilla from the growing point, and afterwards branches; a com-

parison with other Guttiferae however shows that in *H.* we have more probably to do with a union of originally free sta. (see *Nat. Pfl.*, or Pax, *Morphol.* p. 238). The flrs. contain no honey, but offer abundant pollen to insects, and the larger-flowered sp. are frequently visited. They are homogamous, but the stigmas stick out through the sta. and there is thus a chance of a cross when insects alight on the petals.

**Hyphaene** Gaertn. Palmae (II. 3). 9 sp. trop. Afr. The stem is frequently branched, a rare occurrence in Palms.

**Hypochoeris** Linn. Compositae (XIII). 50 sp. N. temp. and S. Am. (3 in Brit.).

**Hypoderris** Br. Polypodiaceae. 1 sp. W. Ind.

**Hypoestes** Soland. Acanthaceae (IV. B). 85 sp. trop. Old World, esp. Madag.

**Hypolepis** Bernh. Polypodiaceae. 12 sp. trop. and S. temp. 1 in Calif.

**Hypopitys** Dill. ex Adans. = *Monotropa* Linn.

**Hypoxis** Linn. Amaryllidaceae (III). 50 sp. S. Afr.

**Hyptis** Jacq. Labiatae (VII). 250 sp. trop., chiefly Am.

**Hyssopus** (Tourn.) Linn. Labiatae (VI. 11). 1 sp. Eur., Medit., As., *H. officinalis* L., the hyssop, formerly used in medicine.

**Hysterophyta** (Warming). The last cohort of Choripetalae (p. 146).

**Iberis** Dill. ex Linn. Cruciferae (II. 6). 30 sp. Eur., As. *I. amara* L. is the candytuft. The outer petals of the flrs. of the corymb are longer than the rest, thus adding to the conspicuousness of the whole (cf. Umbelliferae).

**Icacinaceae.** Dicotyledons (Archichl. Sapindales). 38 gen. with 200 sp., trop. Trees and shrubs (often lianes) or rarely herbs, with. alt. exstip. leaves, usually entire and often leathery. Flrs. in compound paniced infl., regular, usually ♀. K (5) or (4), not enlarged when the fruit is ripe; C 5 or 4, rarely united, valvate or imbricate; A 5 or 4, alt. with petals, with usually introrse anthers; disc rarely developed; G (3) or rarely (5) or (2), rarely multi-loc., usually 1-loc. by abortion of the remaining cavities. Ovules 2 per loc., pendulous from its apex, anatropous, with dorsal raphe and micropyle facing upwards; funicle usually thickened above the micropyle. Style simple with 3 stigmas (or 5—2). Fruit 1-loc., 1-seeded, usually a drupe, sometimes a samara. Endosperm usually present; embryo straight or curved. *Chief genera:* Lasianthera, Phytocrene. [This order was formerly sunk in Olacaceae (c.g. by Benth.-Hooker), but differs in several points; the placenta is never free, the flr. has only one whorl of sta., &c. It is placed in Terebinthinae by Warming.]

**Idesia** Maxim. Flacourtiaceae. 1 sp. China, Japan. [Bixineae, Benth.-Hooker.]

**Ilex** (Tourn.) Linn. Aquifoliaceae. 170 sp. Cent. and S. Am., As., Afr., Austr., Eur. *I. Aquifolium* L., the holly, in Brit. Flrs. dioecious, but in the ♀ flr. the sterile sta. are so large that the flr.

appears ♂. Truly ♀ flrs. sometimes occur. *I. paraguensis* A. St Hil. is the Maté or Paraguay tea, largely used in S. Am. The leaves contain caffeine; they are dried, broken up and used like tea.

**Illiciaceae** (Benth.-Hooker) = Aquifoliaceae.

**Illecebraceae** (Benth.-Hooker) = Paronychiaceae of other authors. Now placed in Caryophyllaceae (q.v.).

**Illecebrum** Rupp. ex Linn. Caryophyllaceae (II. 4). 1 sp. W. Eur. (incl. Devon and Cornwall), Medit., W. Afr.

**Illicium** Linn. Magnoliaceae (3). 7 sp. Am., As. *I. anisatum* Gaertn., the star-anise (China), is used for flavouring on account of the aromatic oil it contains, especially in the fruit. There is a gradual transition in the spiral perianth from sepaloid to petaloid structure (cf. Nymphaea). The fruit is an aggregate of follicles.

**Illice** F. Muell. = Bassia Koenig.

**Impatiens** Riv. ex Linn. Balsaminaceae. 140 sp. trop. and N. temp. Many sp. of balsam are in cultivation, e.g. *I. Noli-tangere* L., the touch-me-not. The name is derived from the explosive fruit. It is a capsule with fleshy pericarp; the outer layers of cells are highly turgid and thus a great strain is put upon the whole. Dehiscence is septifragal and is started by the least touch when the fruit is ripe. The valves roll up inwards with great violence (starting at the base) and the seeds are scattered in all directions.

**Incarvillea** Juss. Bignoniaceae (II). 5 sp. E. and Cent. As. Leaves alt.

**Incompletæ** (Benth.-Hooker) = Monochlamydeae (see p. 144).

**Indigofera** Linn. Leguminosae (III. 6). 250 sp. trop. *I. tinctoria* L. and *I. Anil* L. furnish indigo. The plant is mown just before flowering, and soaked in water, whereby a yellowish solution is obtained. This on stirring and exposure to the air oxidises, and an insoluble precipitate of indigo is formed. The flrs. are slightly explosive (cf. Genista).

**Inferæ** (Benth.-Hooker). The 1st series of Gamopetalæ.

**Inga** Scop. Leguminosae (I. 1). 140 sp. trop. and sub-trop. Am.

**Inula** Linn. Compositæ (IV). 90 sp. Eur., As., Afr. (4 in Brit.). The root of *I. Helenium* L., the elecampane, is officinal.

**Iochroma** Benth. Solanaceae (II. 2). 15 sp. trop. Am. *I. macrocalyx* Miers shows a mode of protection of the flower-buds, similar to that in Spathodea, by watery secretion between calyx and corolla.

**Ionidium** Vent. Violaceae. 50 sp. trop. and sub-trop. The roots of *I. Ipecacuanha* Vent. are used in medicine under the name of white Ipecacuanha, in the same way as the true drug (see Psychotria).

**Ionopsidium** Rchb. = Cochlearia Tourn. 1 sp. Portugal, *I. acaule* Rchb. with solitary flrs. in the axils of radical leaves.

**Ionopsis** H. B. et K. Orchidaceae (28). 10 sp. trop. Am., epiphytes.

**Ipecacuanha** Arruda = Psychotria Linn.

**Ipomoea** Linn. (incl. *Anisia* Choisy, *Batatas* Choisy, *Calonyction* Choisy, *Exogonium* Choisy, *Mina* Cerv., *Operculina* Silva Manso,

*Pharbitis* Choisy, and *Quamoclit* Moench, all treated as separate genera in *Nat. Pfl.*). Convolvulaceae (1. 4). About 410 sp. trop. and warm temp. Chiefly climbing herbs or shrubs; many are cultivated for their handsome flrs. (e.g. *I. purpurea* Roth, the morning glory). *I. Batatas* Lam. (*B. edulis* Choisy) is the sweet potato, largely cultivated in warm countries for its tuberous roots, which are used like potatoes. *I. (Exogonium) Purga* Hayne is the Jalap. The rhizome gives off turnip-like roots about the size of apples; they possess purgative properties on account of a resin which they contain.

**Iresine** P. Br. Amarantaceae (4). 26 sp. Am., Afr.

**Iriarteia** Ruiz et Pav. Palmae (1v. 6). 10 sp. trop. S. Am. The stem is supported on aerial roots (cf. *Pandanus*), often to a height of 8 feet above the soil. Some of the branches of these roots are thorny (cf. *Acanthorhiza*). In *I. ventricosa* Mart., the *Paxiuba* palm, the stem has a peculiar egg-like thickening about half-way up (cf. Bombacaceae, *Jatropha*).

**Iridaceae.** Monocotyledons (Liliiflorae). 57 gen. with about 800 sp. trop. and temp.; the chief centres of distribution are S. Afr. and trop. Am. Chiefly herbs with a sympodial tuber or rhizome below ground. Leaves usually equitant in two ranks. Infl. terminal, cymose (1 flr. only in Crocoideae). Flr. ♂, regular or zygomorphic. Perianth 3+3, petaloid, united below into a long or short tube. Sta. 3 (the outer whorl), with extrorse anthers.  $\bar{G}$  (3), 3-loc., with axile placentae (rarely 1-loc. with parietal placentae). Style usually trifid and frequently more or less petaloid. Ovules usually  $\infty$ , anatropous. Loculicidal capsule. Embryo small, in hard endosperm.

*Classification and chief genera* (after Pax):

I. *Crocoideae* (flr. solitary, or several developed centrifugally round a central one; plant small; leaves not exactly in  $\frac{1}{2}$  phyllotaxy): *Crocus*, *Romulea*.

II. *Iridoideae* (flrs. numerous, in spathes, several in each, usually regular; stem distinct; leaves equitant): *Iris*, *Moraea*, *Tigridia*, *Sisyrinchium*.

III. *Ixioidae* (similar, but spathes 1-flowered; flr. often zygomorphic): *Ixia*, *Tritonia*, *Gladiolus*, *Freesia*.

[Placed in Epugynae by Benth.-Hooker; Liliiflorae by Warming.]

**Irideae** (Benth.-Hooker) = Iridaceae.

**Iris** Tourn. ex Linn. Iridaceae (II). About 100 sp. N. temp. 2 in Brit., *I. Pseudacorus* L., the yellow flag, and *I. foetidissima* L., the gladdon. Many sp. are cultivated. Most sp. have a sympodial rhizome with equitant isobilateral leaves, and small cymes of flrs. in spathes. Perianth petaloid, the sepals usually bending downwards at the outer ends; opposite to them and almost resting on them are the petaloid styles, under which are the sta. with their extrorse anthers. Just above the anther, on the outer side of the style, is a little flap, whose



upper surface is the stigma. Bees entering the flr. to get the honey secreted by the ovary rub off their load of pollen upon the stigma; going farther in they get a fresh supply of pollen; and when they come out close the stigma flap, which prevents self-fertilisation (cf. *Viola*). The flat seeds are suited to wind-distribution.

The dried rhizome of *I. florentina* L. smells like violets, it is known as Orris root, and is largely used in perfumery; 'essence of violets' is made from it.

**Isatis** Tourn. ex Linn. Cruciferae (II. 8). 50 sp. Medit., Eur., As. *I. tinctoria* L. is the woad, largely used as a dye before the introduction of indigo. It is prepared by grinding the leaves to a paste and fermenting them.

**Isnardia** Linn. = *Ludwigia* Linn.

**Isoetaceae.** Lycopodiinae (Heterosporous). Only genus *Isoetes* (q.v.).

**Isoetes** Linn. Isoetaceae. 50 sp. temp. and trop. *I. lacustris* L. is the quill-wort of Brit. lakes, and *I. echinospora* Dur. is also found. Most sp. are aquatics with short stout rhizomes and awl-shaped leaves, the habit being very like that of *Littorella*, with which I. is frequently confused. The stem grows in thickness, but very slowly. The leaves spread out at the base and sheath the stem. There are a number of roots, which branch dichotomously. Above the base of each leaf, on the inner side, is a large sporangium sunk in the tissue. The outer leaves have micro- the inner mega- sporangia, whilst the innermost leaves of all are usually small and not sporangiferous. The sporangia are imperfectly chambered up by strands of tissue, (*trabeculae*) running across them from front to back. The germination of the spores and the development of the embryo resemble the corresponding processes in *Selaginella*.

I. is frequently placed with the Eusporangiate Filicineae (see Campbell, *Mosses and Ferns*). It differs so much from all other Pteridophyta that the determination of its relationships is a matter of great difficulty.

**Isolepis** R. Br. = *Scirpus* Linn.

**Isoloma** Dcne. (*Kohleria* Regel). Gesneraceae (II). 40 sp. trop. Am.

Several sp. form runners above ground, thickly covered with scaly leaves.

**Isonandra** Wight. Sapotaceae (I). 6 sp. Ceylon to Sumatra. [*I. Gutta* Hook. = *Dichopsis Gutta*.]

**Isopogon** R. Br. Proteaceae (I). 29 sp. Austr.

**Isopyrum** Linn. Ranunculaceae (2). 17 sp. temp. As.

**Isotoma** Lindl. Campanulaceae (III). 6 sp. Austr., 1 W. Ind., 1 Society Is.

**Ixia** Linn. Iridaceae (III). 25 sp. S. Afr.

**Ixiolirion** Fisch. Amaryllidaceae (I). 2 sp. W. As.

**Ixora** Linn. Rubiaceae (II. 14). 100 sp. trop. The flr. is commonly red with a long narrow tube, and probably, therefore, butterfly-visited (p. 67). The mechanism is like that of *Campanula*.

**Jaborosa** Juss. Solanaceae (II. 5). 8 sp. Mexico, temp. S. Am.

**Jacaranda** Juss. Bignoniaceae (II). 30 sp. trop. Am.

**Jacksonia** R. Br. Leguminosae (III. 2). 37. sp. Austr.

**Jacobinia** Moric. Acanthaceae (IV. B). 20 sp. trop. Am.

**Jacquemontia** Choisy. Convolvulaceae (I. 4). 40 sp. trop. Am., Afr., Sandw. Is.

**Jacquinia** Linn. Myrsinaceae (I). 6 sp. trop. Am.

**Jambosa** DC. = *Eugenia* Mich.

**Jasione** Linn. Campanulaceae (I. 1). 5 sp. Medit., Eur. *J. montana* L., the sheep's-bit scabious, is common in Brit., especially in hilly districts. The flr. is of interest as affording—like *Phyteuma*, but in a slightly different way—an intermediate step between *Campanula* and the Compositae, in the floral mechanism. The tube is formed by the anthers, which cohere at their base, while the petals spread out as soon as the bud opens.

**Jasminaceae** (Warming) = Oleaceae (suborder II.).

**Jasminum** (Tourn.) Linn. Oleaceae (II). 160 sp. trop. and sub-trop. Erect or twining shrubs, often cultivated for their sweet scented flrs. (Jasmine). The fruit is vertically constricted into two lobes.

**Jasione** Cass. Compositae (IV). 2 sp. Medit.

**Jateorhiza** Miers. Menispermaceae. 2 sp. trop. Afr. *J. Columba* Miers (*J. palmata* Miers) furnishes *Radix Columba*, used as a tonic.

**Jatropha** Linn. Euphorbiaceae (A. II. 3). 70 sp. trop. and sub-trop. *J. podagrica* Hook., frequently cultivated, is a xerophyte with egg-shaped swollen stem, consisting mainly of water-storing tissue; the leaves fall in the dry season (p. 182). The axis of the infl. is red, as well as the flrs. The first branches of the dichasium end in ♀ the later in ♂ flrs. (cf. *Begonia*).

**Jatrorrhiza** Prantl = *Jateorhiza* Miers.

**Jeffersonia** Bart. Berberidaceae. 2 sp. N. Am., E. As.

**Juanullosa** Ruiz et Pav. Solanaceae (IV. 7). 10 sp. trop. Am. *J. parasitica* R. et P. is not a parasite, but an epiphyte.

**Jubaea** H. B. et K. Palmae (v. 7). 1 sp. Chili, *J. spectabilis* H. B. et K., the Coquito-palm. Palm-honey is prepared by evaporation of the sap, and the tree is useful in other ways.

**Juglandaceae**. Dicotyledons (Archichl. Juglandales). 6 gen. with 40 sp., N. temp., and trop. As. Trees with alt. stip. leaves, with brown hairy winter buds: the buds arise rather high up in the leaf axils, and sometimes several appear in descending order. Infl. monoecious, the ♂ appearing as catkins on the twigs of the previous year, the ♀ as sessile flrs. on the stems of the current year. Perianth typically 4-leaved, but often fewer by abortion. ♂ flr. with 3—40 sta. (more in the lower flrs.); ♀ flr. with epigynous perianth, and 2 cpls. Ovary syncarpous, 1-loc., with 1 erect orthotropous ovule; style short with 2 stigmas. Flr. wind-fertilised; *Juglans* (q. v.) is chalazogamic. Fruit a drupe or nut. Testa thin; seed exalbuminous. *Chief genera*:

*Pterocarya*, *Juglans*, *Carya*. [Placed in Unisexuales by Benth.-Hooker, in *Juglandiflorae* by Warming.]

**Juglandales.** The 2nd cohort of Dicotyledons (Archichl.). See p. 136.

**Juglandaceae** (Benth.-Hooker) = *Juglandaceae*.

**Juglandiflorae** (Warming). The 3rd cohort of Choripetalae. See p. 146.

**Juglans** Linn. *Juglandaceae*. 8 sp. N. temp. *J. regia* L. is the walnut. The  $\sigma$  flr. is 'adnate' to the bract and bracteoles and has 5, 4, 3, or 2 perianth leaves; the lowest flrs. have as many as 20 sta., the upper as few as 6. The fruit is a drupe, with a green fleshy exocarp, and a hard endocarp (the shell). The 'boats' into which the shell splits do not represent each a cpl.; the splitting is down the midribs of the cpls. Within is the seed with its thin brown seed-coat. It is exalbuminous with a basal radicle and two large cotyledons, which are rendered irregular in shape by the presence of partial septa in the ovary. The flr. of *J.* has lately been shown to be chalazogamic (Nawaschin in *Bot. Centr.* 63, 1895; see art. Chalazogamiae).

The wood of the walnut is valued in cabinet-making, &c.; the seeds yield an oil. Many varieties are cultivated for their fruit.

**Julocroton** Mart. *Euphorbiaceae* (A. II. 1). 20 sp. trop. Am. Flrs. in spikes, the  $\varphi$  below, the  $\sigma$  above.

**Juncaceae.** Monocotyledons (*Liliiflorae*). 7 gen. with 200 sp. in damp and cold places, temp. and frigid zones. They have usually a creeping sympodial rhizome, one joint of the sympodium appearing above ground each year as a leafy shoot. The stem does not often lengthen out above ground, except to bear the infl. The leaves are usually narrow, and occasionally centric in structure (*Juncus*). Infl. usually a crowded mass of flrs. borne in cymes of various types, usually monochasial. Flr.  $\varphi$ , regular, wind-fertilised. Perianth 3 + 3, sepaloid, with the odd leaf of the inner whorl posterior; sta. 3 + 3 (or the inner wanting), anthers dehiscing laterally, pollen in tetrads; cpls. (3), forming a sup. ovary; placentae axile or parietal, with  $\infty$  or few anatropous ovules. Style simple, with 3 brush-like stigmas. Loculicidal capsule. Embryo straight, in starchy endosperm. *Chief genera:* *Prionium*, *Juncus*, *Luzula*. [Placed in *Calycinae* by Benth.-Hooker, in *Glumiflorae* by Warming.]

**Juncaginaceae.** Monocotyledons (*Helobieae*). 4 gen. with 10 sp., temp. Perennial marsh herbs of grass-like habit; in the axils of the sheathing leaves are 'squamae intravaginales' (cf. *Potamogetonaceae*). Flrs.  $\varphi$ , in racemes, regular, greenish, wind-fertilised, protogynous. P 3 + 3, A 3 + 3, anthers extrorse;  $\bar{G}$  3 + 3 sometimes united, but the outer whorl is often abortive; stigmas sessile; 1 anatropous ovule in each cpl. Achenes or schizocarp. Seed exalbuminous; embryo straight. *Chief genera:* *Triglochin*, *Scheuchzeria*, *Lilaea*. The order is joined to *Naiadaceae* by Benth.-Hooker.

**Juncus** (Tourn.) Linn. *Juncaceae*. 160 sp. cosmop. but chiefly in cold, wet places. 18 sp. of rush are found in Brit. Most sp. have a sym-

podial rhizome giving off one leafy shoot each year. The leaves are of various types, with large sheathing bases. Some are flat and grass-like, others needle-like, and still others centric in structure and standing erect. These last are chiefly found in the sp. inhabiting level plateaus in northern regions, where the light in summer comes from almost every direction in turn, and it has been suggested (see p. 192) that the erect position and centric structure is due to this; probably there is some correlation between the two phenomena. The infl. is a dense head or panicle, of cymose construction (usually rhipidia or drepania; see p. 52). In some sp. it appears to be lateral on a leaf-like cylindrical stem, but is really only pushed to one side by the bract of the infl. Flr. protogynous and wind-fertilised.

Rushes are largely used for making baskets, chair bottoms, &c.

*J. squarrosus* L. is common on hill pastures in Brit.; it is eaten by sheep and forms a valuable part of their fodder when grass is scarce.

**Juniperus** Tourn. ex Linn. Coniferae (Arauc. 2 d; see C. for genus characters). 30 sp. N. Hemisp. The common Juniper, *J. communis* L. (Asia and Eur. incl. Britain), and *J. Oxycedrus* L., &c. have needle leaves throughout life; others, such as *J. Sabina* L., the Savin (Eur. As.), have small leaves closely appressed, as in Cupressus. Seedling forms of these are known (see Retinospora). The cone consists of 1—4 whorls of scales, one only being fertile, as a rule. In ripening the whole becomes a fleshy mass enclosing the hard seeds, and forming a good imitation of a true berry. The fruit is eaten by birds. That of *J. communis* is used in making gin. The wood of *J. virginiana* L. is the red cedar used for pencils.

**Jurinea** Cass. Compositae (X1). 50 sp. Medit., Eur., As.

**Jussieua** Linn. (Jussiaea). Onagraceae (1). 36 sp. trop.; water and marsh plants. Aerating tissue is well developed (cf. Sonneratia, Sesbania, and see p. 172). In *J. repens* L. (*J. diffusa* Forsk.), when growing in water, two forms of root develop, ordinary anchorage roots and erect spongy roots which grow upwards, often till they reach the surface of the water. The bulk of the tissue consists of aerenchyma. In *J. suffruticosa* L. (*J. salicifolia* H. B. et K.) there is an erect stem, whose lower part is covered with aerenchyma if growing in water (cf. Lycopus). If the plants be grown on land none of these phenomena appear. [Figs., &c. in Goebel's *Pflanzenbiol. Schild.* II. 256.]

**Justicia** Houst. ex Linn. Acanthaceae (IV. B). 250 sp. trop.

**Kadsura** Kaempf. Magnoliaceae (2). 7 sp. trop. As. and Japan. Flrs. unisexual, spiral throughout. Climbing shrubs with no stipules.

**Kaempferia** Linn. Zingiberaceae. 18 sp. trop. Afr., E. Ind.

**Kalanchoë** Adans. Crassulaceae. 55 sp. trop. Like Bryophyllum.

**Kalmia** Linn. Ericaceae (I. 3). 6 sp. N. Am. The anthers are held in 'pockets' of the corolla, and thus, when the flr. is open, the filaments are bent like bows. An insect probing on the outer side of the

- filaments for honey, releases the anthers, which fly up, shooting the pollen out upon the under side of the visitor.
- Karatas** (Plum.) Mill. (incl. *Nidularium* Lam.). Bromeliaceae (1). 18 sp. W. Ind., Brazil.
- Kaufmannia** Regel. Primulaceae (1). 1 sp. Turkestan.
- Kaulfussia** Blume. Marattiaceae (11). 1 sp. S. E. As. The palmate leaf has large pores on the under side, due to the tearing apart of guard cells of stomata.
- Kennedya** Vent. (excl. *Hardenbergia* Benth.). Leguminosae (111. 10). 12 sp. Austr. The flrs. of some sp. are almost black.
- Kentia** Blume. Palmae (IV. 6). 10 sp. Moluccas to N. Z. (not in Austr.). Flrs. in groups of 3 (2 male) on the spadix.
- Kerneria** Medic. = *Cochlearia* Linn. (5 sp. Alps.)
- Kerria** DC. Rosaceae (III. 5). 1 sp. E. As. *K. japonica* DC., often cultivated, especially in the double-flowered form.
- Kibara** Endl. Monimiaceae. 10 sp. E. Ind. to Austr.
- Kickxia** Blume. Apocynaceae (II. 4). 2 sp. trop. Afr., Java.
- Kielmeyera** Mart. Guttiferae. 17 sp. Campos of Brazil. [Ternstroemiaceae, Benth.-Hooker.]
- Kigelia** DC. Bignoniaceae (IV). 3 sp. trop. Afr., Madag. The infls. are borne on old wood (p. 35), hanging down on very long stalks.
- Kingia** R. Br. Liliaceae (111). 1 sp. W. Austr., a characteristic plant of the district. Placed in Juncaceae by Benth.-Hooker.
- Kitabelia** Willd. Malvaceae (1). 1 sp. lower Danube.
- Kleinia** Linn. = *Senecio* Tourn.
- Knappia** Sm. = *Mibora* Adans.
- Knautia** Linn. = *Scabiosa* Tourn.
- Kniphofia** Moench. Liliaceae (111). 16 sp. S. Afr., often cultivated for their handsome spikes of flrs. Bees sometimes force their way into the flrs. and are unable to return.
- Kobresia** Willd. Cyperaceae (II). 4 sp. As., Eur. (1 Brit.).
- Kochia** Roth. Chenopodiaceae (5). 30 sp. cosmop.
- Koerberlinia** Zucc. Koerberliniaceae. 1 sp. Texas, Mexico. A leafless xerophyte with thorny twigs.
- Koerberliniaceae**. Dicotyledons (Archichl. Parietales). Only genus *Koerberlinia* (q. v.), placed in Simarubaceae by Benth.-Hooker. See *Nat. Pfl.*
- Koeleria** Pers. Gramineae (X). 15 sp. temp. (1 Brit.).
- Koelreuteria** Laxm. Sapindaceae (10). 2 sp. China. The capsule is large and bladdery and may be blown about by wind (cf. *Colutea*).
- Koenigia** Linn. = *Polygonum* Tourn.
- Kohleria** Regel = *Isoloma* Dcne.
- Koniga** R. Br. = *Alyssum* Tourn.
- Korthalsia** Blume. Palmae (111). 20 sp. E. Ind. Some, e.g. *K. horrida* Becc., are said to be myrmecophilous (cf. *Cecropia*), the ants living in the sheaths of the leaves.

**Krameria** Loeffl. Leguminosae (II. 6). 13 sp. Mexico to Chili. It is placed in Polygalaceae by Benth.-Hooker, but has a petal, not a sepal, posterior. K and C 4—5; A 4, anthers opening by pores. See Eichler, *Bluthendiag.* p. 522.

**Kraunhia** Rafin. = *Wistaria* Nutt.

**Krockeria** Moench = *Lotus* Linn.

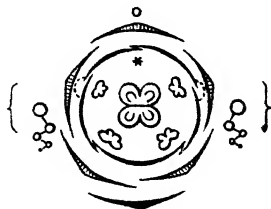
**Krynitzkya** Fisch. et Mey. Boraginaceae (IV. 2). 40 sp. W. Am.

**Kuhnistera** Lam. = *Petalostemon* Michx.

**Kyllinga** Rottb. Cyperaceae (II). 40 sp. trop.

**Labiatae.** Dicotyledons (Sympet. Tubiflorae). About 150 gen. with 2800 sp., cosmop. The chief centre is the Medit. region. Some of the small sub-orders are localised in their distribution, *e.g.* II. in Austr. and Tasmania, III. in India, Malaya, China, &c., VIII. in Centr. Am., whereas the large ones, such as I. and IV., are cosmop. Most L. are land-plants, and herbs or undershrubs, exhibiting much similarity in habit and structure. Stem usually square, with decussate simple exstip. leaves, often hairy and with epidermal glands secreting volatile oils, which give characteristic scents to many plants of the order. There are a few marsh-plants (*Mentha*, *Lycopus*, &c.), a few climbers (sp. of *Stenogyne*, *Scutellaria*, &c.), and a few small trees (*Hyptis* sp.). Many are xerophytes with reduced, sometimes infolded, leaves, hairiness, thick cuticles, &c., *e.g.* *Rosmarinus*.

The axis of the first order is not closed by a flr. but only those of later orders; thus the primary form of the infl. is racemose, and a simple raceme actually occurs in *Scutellaria*, &c. Usually however a dichasial cyme, becoming cincinnal in its later branchings (p. 52), occurs in the axil of each leaf upon the upper part of the main axis. In *Teucrium*, *Nepeta* sp., &c., the construction of this cyme is easily seen; but in most L. it is closely 'condensed' into the axil, so that all the flrs. are sessile; even here, however, it is easily seen that the central flr. opens first and then those on either side of it (see diagram). The two condensed cymes at each node overlap the leaf-axils and often form what looks like a whorl of flrs.; this infl. is often called a *verticillaster* or false whorl.



Floral diagram of *Lamium album* with indication of the dichasial double cincinnus at the sides. (After Eichler.) The asterisk represents the missing posterior sta.

Flr. ♀ or gynodioecious, zygomorphic, hypogynous, 5-merous with suppression in some whorls. The common formula is K (5), C (5), A 4,  $\underline{\underline{G}}$  (2). Calyx hypogynous, tubular, bell- or funnel-shaped, sometimes 2-lipped, persistent in fruit. Corolla usually 2-lipped with no clear indication of the individual petals. Sta. 4, didynamous, or of nearly equal length, sometimes 2, epipetalous with introrse anthers.

Ovary on a nectariferous disc (often developed on anterior side only), of (2) cpls. placed antero-posteriorly. Early in its development a constriction appears in the ovary in the antero-posterior line, dividing each cpl. into 2 loculi, so that the ovary becomes 4-loc. as it matures. Each of the 4 portions is nearly independent of the rest, and the style springs between them from the base of the ovary (*i.e.* is *gynobasic*); stigma 2-lobed. Placentae axile, each with 1 basal erect anatropous ovule with ventral raphe. The fruit is usually a group of 4 achenes or *nutlets*, each containing one seed; sometimes it is a drupe. Seed with no endosperm or very little; the radicle of the embryo points downwards (*cf.* Boraginaceae).

The flrs. of *L.* belong in general to the classes H. and F. (pp. 70, 67). The 2-lipped corolla ensures that the visiting insect shall take a definite position in regard to the anthers and stigma whilst probing for the honey at the base of the flr. The lower lip acts as a flag to attract insects, and also as a landing-place, whilst the upper lip shelters the essential organs, which are usually placed so as to touch the insect's back. The length of the corolla-tube varies very much, and with it the kind of visitors. Most Brit. sp. are bee flrs., the long-tubed red flrs. of *Monarda* &c. are butterfly flrs., and a few sp. of *Salvia* &c. are humming-bird flrs. (p. 103). The pollination-mechanism is usually simple; in *Lamium*, &c. the flr. is homogamous, the stigma merely projecting beyond the anthers so as to be touched first, but usually the flr. is dichogamous (protandrous), often with movements of the essential organs, *e.g.* in *Teucrium*, &c. The lever-mechanism of *Salvia* is almost unique. *Thymus*, *Origanum*, and their allies, have nearly regular flrs. visited by a more miscellaneous selection of insects. In many *L.*, especially § VI., interesting distributions of sex appear, especially gynodioecism (p. 89).

A few *L.* disperse their fruits by aid of the persistent bladdery calyx, which acts as a sail; a few have hooks formed from the calyx-teeth. The stalks are very often hygroscopic and move in such a way as to favour the dispersal of the fruits in wet weather (see Miss Pertz in *Nat. Science*, Oct. 1894).

The *L.* are useful on account of the volatile oils which they contain; many, *e.g.* *Thymus*, *Ocimum*, *Origanum*, *Salvia*, &c., are used as condiments. Oils and perfumes are obtained by distillation from *Rosmarinus*, *Pogostemon*, *Lavandula*, &c. Food-products are obtained from *Stachys* sp.

*Classification and chief genera* (after Briquet, from whose account much of the above is condensed): the *L.* are closely allied to *Verbenaceae*; from *Boraginaceae* the position of the radicle sharply separates them, whilst the similarity to *Scrophulariaceae*, &c. is largely in minor characters.

A. Style not gynobasic. Nutlets with lateral-ventral attachment and usually large surface of contact (often  $> \frac{1}{2}$  as high as ovary).

- I. *AFUGOIDEAE* (seed exalbuminous):
  1. *Ajugeae* (corolla various; upper lip if present rarely concave; sta. 4 or 2; anther 2-loc.; nutlets  $\pm$  wrinkled): *Ajuga*, *Teucrium*.
  2. *Rosmarineae* (corolla strongly 2-lipped; upper lip very concave and arched; sta. 2; anthers 1-loc.; nutlets smooth): *Rosmarinus* (only genus).
- II. *PROSTANTHEROIDEAE* (seed albuminous): *Prostanthera*.
- B. Style perfectly gynobasic. Nutlets with basal attachment and usually small surface of contact, rarely with  $\pm$  basal-dorsal attachment.
- III. *PRASIOIDEAE* (nutlet drupaceous with fleshy or very thick exocarp and hard endocarp): *Stenogyne*, *Gomphostemma*.
- IV. *SCUTELLARIOIDEAE* (nutlet dry; seed  $\pm$  transversal; embryo with curved radicle lying on one cotyledon): *Scutellaria*.
- V. *LAVANDULOIDEAE* (nutlet dry; seed erect; embryo with short straight superior radicle; disc-lobes opp. to ovary-lobes; nutlets with  $\pm$  distinct dorsal-basal attachment; sta. 4 included; anthers 1 loc. at tip through union of thecae): *Lavandula* (only genus).
- VI. *STACHYDOIDEAE* (ditto, but disc-lobes, when distinct, alt. with ovary-lobes; nut with small basal attachment; sta. ascending or spreading and projecting straight forwards):
  1. *Marrubieae*: *Marrubium*, *Sideritis*.
  2. *Perilomieae*: *Perilomia* (only genus).
  3. *Nepeteae*: *Nepeta*, *Dracocephalum*.
  4. *Stachydeae*: *Prunella*, *Phlomis*, *Galeopsis*, *Lamium*, *Ballota*, *Stachys*.
  5. *Glechoneae*: *Glechon*.
  6. *Salvieae*: *Salvia*.
  7. *Meriandreae*: *Meriandra*.
  8. *Monardeae*: *Monarda*, *Ziziphora*.
  9. *Hormineae*: *Horminum*.
  10. *Lepechinieae*: *Lepechinia*.
  11. *Satureieae*: *Calamintha*, *Satureia*, *Origanum*, *Thymus*, *Mentha*.
  12. *Pogostemoneae*: *Pogostemon*.
- VII. *OCIMOIDEAE* (as VI., but sta. descending, lying upon under lip or enclosed by it): *Hyptis*, *Ocimum*.
- VIII. *CATOPHERIOIDEAE* (nutlet dry; seed erect; embryo with curved radicle lying against the cotyledons): *Catopheria*.  
[L. are placed in Lamiales by Benth.-Hooker, in Nuculiferae by Warming.]



- Laburnum** Linn. Leguminosae (III. 3). 3 sp. Eur., W. As., of which *L. vulgare* J. Presl. is the common laburnum of shrubberies. The flr. has a simple Trifolium-mechanism. There is no free honey; bees pierce the swelling at the base of the vexillum (cf. Orchis). All parts are poisonous.
- Lachenalia** Jacq. Liliaceae (v). 30 sp. S. Afr. *L. tricolor* Jacq. a pretty little bulbous plant with two leaves, is in cultivation.
- Lachnanthes** Ell. Haemodoraceae. 1 sp. *L. tinctoria* Ell., N. Am., the paint-root. The roots yield a red dye. See *Orig. of Species*, 6th ed., p. 9.
- Lacistema** Sw. Lacistemaceae. 16 sp. trop. Am.
- Lacistemaceae**. Dicotyledons (Archichl. Piperales). Only genus *Lacistema*. Closely allied to Piperaceae. See *Nat. Pfl.*
- Lactoridaceae**. Dicotyledons (Archichl. Ranales). An order composed of the single sp. *Lactoris fernandeziana* Phil. from Juan Fernandez (p. 158). See *Nat. Pfl.* Placed in Piperaceae by Benth.-Hooker.
- Lactoris** Phil. Lactoridaceae. See order.
- Lactuca** (Tourn.) Linn. (incl. *Mulgedum* Cass.). Compositae (XIII). 90 sp. chiefly N. temp. Old World; 4 in Brit. *L. Scariola* L., the prickly lettuce, is a compass-plant when growing in dry exposed places (see Silphium). *L. sativa* L. is the common lettuce used in salads. Its value depends on the latex. Flr. like Hieracium. The former is rapidly spreading in the U. S. as a weed (p. 151).
- Ladenbergia** Klotzsch (excl. *Casuarilla* Wedd.). Rubiaceae (I. 4). 10 sp. S. Am.
- Laelia** Lindl. Orchidaceae (13). 20 sp. trop. Am. Often epiphytic. Like Cattleya.
- Lagenandra** Dalz. Araceae (VII). 4 sp. Ceylon.
- Lagenaria** Ser. Cucurbitaceae (III). 1 sp. trop. Old World, *L. vulgaris* Ser., the calabash-cucumber. The outer woody pericarp of the fruit makes an excellent flask.
- Lagerstroemia** Linn. Lythraceae. 23 sp. Madag. to E. As. and Austr. Some are heterostyled like Lythrum.
- Lagetta** Juss. Thymelaeaceae. 3 sp. W. Ind. *L. Lintearia* Lam. is the lace tree. Its bast-fibres on removal from the stem (by maceration, &c.) form a network used for making dresses, &c.
- Lagoecia** Linn. Umbelliferae (3). 1 sp. Medit. One of the usual two loc. of the ovary is aborted.
- Lagurus** Linn. Gramineae (VIII). 1 sp. Medit., *L. ovatus* L., cultivated as an ornamental grass and for use in bouquets.
- Lamarckia** Moench. Gramineae (X). 1 sp. Medit.
- Lamiales** (Benth.-Hooker). The 10th cohort of Gamopetalae (p. 144).
- Lamium** (Tourn.) Linn. Labiatae (VI. 4). 40 sp. Eur., As., extratrop. Afr. 5 in Brit., of which the chief are *L. album* L. (white dead-nettle), *L. amplexicaule* L. (henbit), *L. purpureum* L. (purple dead-nettle) and *L. Galeobdolon* Crantz (yellow archangel). *L. album* has

sympodial rhizomes and large white homogamous humble-bee flrs. *L. amplexicaule* has cleistogamic flrs. in spring and autumn; they look like ordinary buds with a small corolla, and are pollinated without opening (p. 92).

**Lampsana** (Tourn.) Rupp. = *Lapsana* Linn.

**Landolphia** Beauv. Apocynaceae (1). 16 sp. trop. and S. Afr. Several are lianes with curious hook tendrils like those of *Strychnos*. The fruit is a large berry full of an acid pulp composed of the hair-structures on the seeds. Several sp., e.g. *L. Kirkii* Dyer, *L. comorensis* Benth. et Hook. f., &c., yield indian-rubber, the latex, coagulated, which exudes from a wound. It is known in trade as African rubber.

**Langsdorfia** Mart. Balanophoraceae. 1 sp. *L. hypogaea* Mart., trop. Am.

**Lankesteria** Lindl. Acanthaceae (IV. A). 4 sp. trop. W. Afr.

**Lantana** Linn. Verbenaceae (II). 50 sp. trop. and sub-trop. Shrubs, often used for making hedges. Some have edible fruit.

**Lapageria** Ruiz et Pav. Liliaceae (X). 1 sp. Chili, *L. rosea* Ruiz et Pav., a climbing shrub with handsome flrs. and edible fruit, often grown in greenhouses.

**Lapeyrousia** Pourr. Iridaceae (III). 22 sp. S. and trop. Afr.

**Laportea** Gaudich. Urticaceae (1). 25 sp. trop. Many sting violently.

**Lappa** (Tourn.) Rupp. = *Arctium* Linn.

**Lapsana** Linn. Compositae (XII). 9 sp. N. temp. Old World. *L. communis* L., the nipplewort, is common in Brit. The flrs. are inconspicuous and pollinate themselves regularly. There is no pappus.

**Lardizabala** Ruiz et Pav. Lardizabalaceae. 2 sp. Chili. A tough fibre is got from the stems of *L. biternata* Ruiz et Pav.

**Lardizabalaceae**. Dicotyledons (Archichl. Ranales). 7 gen. with 12 sp. Himal. to Japan, and Chili. Mostly climbing shrubs with palmate leaves. Flrs. in racemes, usually in the axils of the scale-leaves at the bases of the branches, polygamous or diclinous. The usual formula is  $P\ 3+3$ ;  $A\ 3+3$ ,  $\underline{G}\ 3$  or more. 2 whorls of small honey-leaves (see Ranunculaceae) often occur between perianth and sta. Sta. sometimes united; anthers extrorse. Ovules  $\infty$  in longitudinal rows on the lateral walls (cf. Nymphaeaceae), anatropous. The fr. of either sex shows rudiments of the organs of the other sex. Fruit a berry. Embryo small and straight, in copious endosperm. *Chief genera*: Decaisnea, Akebia, Lardizabala. Benth.-Hooker unite *L.* to Berberidaceae, to which and to Menispermaceae they are closely allied. Warming places *L.* in Polycarpicae.

**Larix** Tourn. ex Adans. Coniferae (Arauc. 1 b; see C. for genus characters). 8 sp., five in Eur. and N. As., three in N. Am. The general characters are those of *Cedrus*, but the leaves are deciduous (p. 165), and the cones ripen in a single year. *L. europaea* DC. (*L. decidua* Mill.) is the common larch, cultivated on a large scale for its

- wood, bark (used in tanning) and turpentine (Venice t.). *L. pendula* Salisb. (*L. americana* Michx.) is a common N. Am. sp.
- Larrea** Cav. Zygophyllaceae. 4 sp. sub-trop. Am. Xerophytes. *L. mexicana* Moric. (Mexico, &c.) is the creosote plant, which forms a dense scrub-vegetation and binds the drifting sand together. Its strong smell prevents it from being eaten by animals.
- Laserpitium** Linn. Umbelliferae (9). 20 sp. Eur., N. Afr., As.
- Lasiandra** DC. = Tibouchina Aubl.
- Lasiandra** Beauv. Icacinaceae. 1 sp. trop. W. Afr. (Olacineae, Benth-Hooker).
- Lasianthus** Jack. Rubiaceae (11. 15). 80 sp. E. As., Indo-mal., N. Austr.
- Lasiopetalum** Sm. Sterculiaceae. 25 sp. Austr.
- Lasthenia** Cass. Compositae (vi). 5 sp. W. Am.
- Lastrea** Presl = Nephrodium Rich. (usually same spec. names).
- Latania** Comm. ex Juss. Palmae (11. 3). 3 sp. E. Afr., Mascarenes.
- Lathraea** Linn. Orobanchaceae. 5 sp. temp., Eur., As. *L. Squamaria* L. in Brit. (tooth-wort). This sp. is a curious parasite living upon the roots of hazel, beech, &c. It has a thick rhizome bearing 4 rows of tooth-like scaly leaves. The flowering shoot comes above ground and bears a raceme of purplish flrs. The flrs. are all bent round to the same side of the infl. (p. 55), and are protogynous. The scales upon the rhizome are curiously hollowed, each containing a branched cavity opening to the outside by a narrow slit at the base of the back of the leaf. This arises by a development similar to that which forms the chambers in the leaves of *Empetrum*, *Cassiope*, &c. In the small lateral cavities opening out of the main one there are found peculiar glandular organs, resembling those of insectivorous plants (p. 195). Some are of two cells, forming a small head, upon a one-celled stalk; others are sessile, of 2—4 cells. From the surface of both kinds radiate hyaline threads, whose nature has caused much discussion. Some affirm them to be protoplasmic, others of waxy or even bacterial nature. Small insects &c. are often found in these leaves (cf. bladders of *Utricularia*, &c.) and it has been supposed that these organs absorb their proteid materials after the manner of the glands of *Drosera*, &c. This however is very doubtful, but it is quite possible that the plant may absorb the products of their decay. It seems probable that *L.* is able to some extent to nourish itself saprophytically. Another common sp. in Eur. is *L. clandestina* L., parasitic upon willows. The capsule of *L.* splits explosively. [For details see Heinricher in *Sitz. k. Akad. Wien*, CI. 1892, *Berichte D. Bot. Ges.* 1893, 1895, and *Cohn's Beitr.* VII. (reviewed in *Bot. Centr.* 65, p. 307).]
- Lathyrus** (Tourn.) Linn. (incl. *Orobis* Linn.). Leguminosae (III. 9). 100 sp. N. temp., and Mts. of trop. Afr. and S. Am. 10 sp. in Brit. (pea), including *L. Aphaca* L. and *L. Nissolia* L. The former has

large green stipules performing assimilatory functions, whilst the leaf is transformed into a tendril; the latter has its petioles flattened into phyllodes and has no leaf blade at all (see *Acacia*). *L. macrorrhizus* Wimm. has tuberous roots which may be eaten like potatoes. *L. sativus* L. (Jarosse) and *L. Cicer* L. are cultivated in S. Eur. as fodder and are also eaten like chick-pea (*Cicer*). *L. odoratus* L. is the sweet-pea. The flr. is like that of *Vicia*; on the style is a tuft of hairs that brushes the pollen out of the apex of the keel, where it is shed by the anthers.

**Lauraceae.** Dicotyledons (Archichl. Ranales). 40 gen. with 1000 sp. trop. and sub-trop.; the chief centres of distribution are S.E. As. and Brazil. Trees and shrubs with leathery evergreen alt. exstip. leaves. The tissues contain numerous oil-cavities. *Cassytha* is an interesting parasite. Infl. racemose, cymose, or mixed. Flr. actinomorphic, apetalous, usually 3-merous, ♂ or monœcious. The formula is usually  $P_{2n}, A_{4n}, \underline{C}_n$ . Perianth in two whorls, perigynous. Sta. perigynous or epigynous, in 3 or 4 whorls, some of which are commonly reduced to staminodes; anther usually 4-loc. opening by valves (cf. *Berberidaceae*). The anthers are usually introrse, but in many cases those of the third whorl are extrorse. The axis is more or less concave, and the ovary is free from it at the sides. Cpls. 1 (Payer, Baillon) or more probably 3 (Eichler), forming a 1-loc. ovary, with 1 pendulous anatropous ovule. Fruit a berry, often more or less enclosed by the cup-like receptacle, which also becomes fleshy in these cases. Embryo straight; seed exalbuminous. The position of the L. in the system is doubtful; they apparently form the connecting link between the Ranales (to the more typical families of which they are linked by *Monimiaceae* and *Calycanthaceae*) and the *Thymelaeales*. They are placed in *Daphnales* by Benth.-Hooker, in *Polycarpiceae* by Warming. Important economic plants are found in nearly all the genera mentioned below. [See *Nat. Pfl.* and Mez in *Bot. Jahresh.* 1889, p. 459, and *Bot. Centr.* 54, p. 275 (abstracts).]

*Classification and chief genera* (after Pax):

I. **PERSOIDEAE** (anther 4-loc.): *Cinnamomum*, *Persea*, *Sassafras*, *Litsea*.

II. **LAUROIDEAE** (anther 2-loc.): *Cryptocarya*, *Lindera*, *Laurus*, *Cassytha*.

**Laurelia** Juss. *Monimiaceae*. 1 sp. N.Z., 1 sp. Chili. The former, *L. Novae-Zelandiae* A. Cunn., supplies a useful timber. The fruits of the latter, *L. aromatica* Juss., are used as a spice under the name of Peruvian nutmegs.

**Laurus** (Tourn.) Linn. *Lauraceae* (II). 2 sp., *L. nobilis* L. the true Laurel or Sweet Bay, *Medit.*, and *L. canariensis* Webb et Berth., *Canaries* and *Madeira*. The leaves of the Bay are aromatic and are used in condiments &c.; the berries are employed in veterinary medicine. Flrs. unisexual by abortion.

- Lavandula** Tourn. ex Linn. Labiatae (v, q.v. for genus characters). 20 sp. Medit. region, from Canaries to India. *L. vera* DC. is the common lavender. From it is obtained oil of lavender, by distillation of the flrs. The oil is used in painting, &c., and in the manufacture of lavender water. *L. Spica* Cav. and *L. Stoechas* L. are also used. The protandrous flrs. are visited by bees and form a good source of honey.
- Lavatera** Linn. Malvaceae (11). 20 sp. chiefly Medit.; 2 in Canaries, 1 Austr., 1 mid-As. *L. arborea* L., tree-mallow, on rocks on the Brit. coast.
- Lavoisiera** DC. Melastomaceae (1). 50 sp. Brazil.
- Lawsonia** Linn. Lythraceae. • *L. inermis* L., the only sp., everywhere cultivated in the tropics, originally E. Afr. to N. Austr. The powdered leaves form the well-known cosmetic, *henna*, used in the East to stain the finger-nails, &c. red.
- Layia** Hook. et Arn. Compositae (v). 14 sp. west N. Am.
- Leandra** Raddi. Melastomaceae (1). 200 sp. trop. Am.
- Lebeckia** Thunb. Leguminosae (III. 3). 24 sp. S. Afr.
- **Lecanopteris** Blume. Polypodiaceae. 1 sp. Indo-mal., often placed in Polypodium.
- Lechea** Kalm. Cistaceae. 4 sp. Am.
- Lecythidaceae**. Dicotyledons (Archichl. Myrtiflorae). 18 gen. with 220 sp. of trop. trees. The leaves are generally in bunches at the ends of the twigs, simple, exstipulate. Flrs. single or in racemose infls., ♂, perigynous or epigynous, with complete fusion of receptacle and ovary. K 4—6, C 4—6, A ∞ in several whorls, the sta. more or less united at base. Ovary with 2—6 or more loc., in each 1—∞ anatropous ovules. There is usually an intra-staminal disc as well as one under petals and sta. Berry or capsule. No endosperm. Bertholletia and others are economic plants. Chief genera: Barringtonia, Napoleona, Couroupita, Lecythis, Bertholletia. United to Myrtaceae by Benth.-Hooker and Warming.
- Lecythis** Loeffl. Lecythidaceae. 30 sp. trop. S. Am. The fruit is a huge wooden capsule, opening by a lid. The oily seeds are eaten as Sapucaia nuts. The empty fruit is termed a 'monkey-pot' from its use in catching monkeys. It is filled with sugar, the monkey inserts its hand, clasps it, and then cannot withdraw it.
- Ledum** Rupp. ex Linn. Ericaceae (1. 1). 3 sp., two in N. Am., *L. palustre* L. circumpolar. The leaves are rolled back (cf. Empetrum). This sp. is used in Labrador as tea. Seeds winged at ends.
- Leca** Royen. Vitaceae (11). 45 sp. trop. Old World.
- Leernia** Soland. ex Sw. Gramineae (v1). 5 sp. N. temp. and trop. Marsh grasses similar to *Oryza*, and used as fodder in As. *L. oryzoides* Sw. (Eur.) has cleistogamic flrs. (Darwin, *Forms of Flrs.*, p. 335).
- Leguminosae**. Dicotyledons (Archichl. Rosales). The second largest family of flowering plants, with about 440 gen. and 7000 sp.,

cosmop. Mimosoideae and Caesalpinioideae are mostly trop., Papilionatae mostly temp. (abundant on steppes, &c.). The account here given is largely condensed from that of Taubert in *Nat. Pfl.*

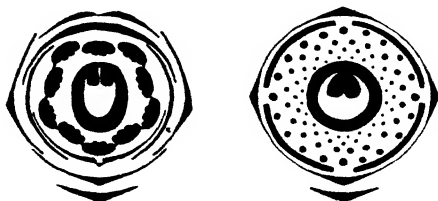
Living in every kind of soil and climate, the L. show great variety in habit—trees, shrubs, herbs, water-plants, xerophytes, climbers, &c. The roots of most sp. exhibit peculiar *tubercles*—metamorphosed lateral roots containing the peculiar bacterial organisms (*Rhizobium* sp.) about which there has been so much discussion in late years. Plants provided with these are able to take up much more atmospheric nitrogen than those not so provided. The plant appears actually to consume the ‘bacteroids’ which live in its cells, after they have stored up in themselves a considerable amount of nitrogenous material. Hence the great value of the L. as a crop on poor soil, or as preceding wheat in the rotation of crops; for instead of impoverishing the soil they rather enrich it, either by the nitrogen contained in their roots and liberated as these decay, or by that of the whole plant if ploughed in as ‘green manure.’

The stem is commonly erect, but many climbers occur. Some, e.g. *Vicia*, climb by leaf-tendrils, some, e.g. *Bauhinia*, by stem-tendrils, some by hooks (modified leaves in *Caesalpinia*, &c., emergences in *Acacia*, &c.), some by twining, and so on. Creeping stems, rooting at the nodes, also occur. Thorns, usually modified branches (e.g. *Gleditschia*) or stipules (e.g. *Acacia*), are common. The stems of the erect trop. sp. often branch in such a way that the branches run parallel and erect, and bear crowns of leaves at the top (p. 165). The stems of many lianes are peculiarly shaped, often flat, or corrugated in various ways, owing to peculiar methods of growth in thickness.

The leaves are usually alt., stipulate, and nearly always compound. Many sp. have very small leaves, e.g. *Ulex*, or scaly leaves and flat stems, e.g. *Carmichaelia*. The stipules vary much in size &c. (see *Acacia*, *Lathyrus*, *Vicia*). The leaves usually perform sleep-movements (p. 30) at night; the direction of motion varies, some moving upwards, some downwards, or in other ways, but the final result is usually to place the leaflet edgewise to the sky. In *Mimosa* and *Neptunia* the leaves are sensitive to a touch and at once assume the sleep-position, recovering after a time. In *Desmodium gyrans* the lateral leaflets execute continuous spontaneous movements as long as the temperature is high enough.

The infl. is apparently always racemose, but with much variety. The simple raceme is very common, also the panicle and spike. Dorsiventral racemes, resembling the cymes of *Boraginaceae*, also occur (e.g. *Dalbergia*). The flrs. are regular (and then frequently polygamous) or irregular (and then usually ♂). The receptacle is usually convex or flat, so that at most the flr. is slightly perigynous. The calyx develops in ascending order and is usually 5-merous, the odd (oldest) sepal being anterior. The sepals are more or less united.

The corolla is polypetalous, alternating with the calyx; its aestivation may be valvate (Mimosoideae), ascending imbricate (Caesalpinioideae), or descending (Papilionatae). In many cases it is zygomorphic to a high degree, having a large petal posterior (vexillum or standard),



Floral diagrams of *Vicia Faba* (Papilionatae) and *Acacia latifolia* (Mimosoideae), after Eichler (modified).

two lateral (alae or wings), and two anterior more or less joined to form a keel or carina. The androeceum consists typically of 10 sta., free or united into a tube; in the latter case the tenth sta. (the posterior one) often remains free, so as to leave a slit in the tube, only covered loosely by this sta. Many variations from the typical androeceum are found. In cases where a keel is present, the sta. are enclosed in it.

The gynoeceum consists typically of one cpl. with its ventral side directly posterior; it has a long style and terminal stigma. There are two rows of ovules (they alternate with one another so as to stand in one vertical rank), anatropous or amphitropous, ascending or pendulous.

*Fertilisation.* Only the Papilionatae have as yet been at all thoroughly studied (and only the European genera of these). The keel encloses the essential organs, protecting them from rain, &c. and rendering the flr. so complex that only the cleverer insects can make much of it. Honey is secreted by the inner sides of the sta. near their base, and accumulates in the stamen-tube round the base of the ovary. In order to render the honey accessible, the tenth sta. is free of the tube, and at the base, on either side of it, are two openings leading to the honey. The honey is thus concealed and at some depth, so that a clever insect with a tongue of moderate length is required. All this points to the P. being bee-flowers, as in fact is the case. Insects visiting the flrs. alight upon the wings and depress them by their weight, whilst they probe for honey under the standard. The wings are always joined to the keel, usually by a protuberance in the former fitting into a suitable hollow in the latter, so that the keel is thus depressed likewise. This causes the emergence of the essential organs, the stigma usually coming first, so that a fair chance of cross-

fertilisation exists. Self-pollination usually occurs when the insect flies off, leaving the keel to return to its former position.

"Four different types of structure may be distinguished (in Papilionatae) according to the manner in which the pollen is applied to the bee: (1) P. in which the sta. and stigma emerge from the carina and again return within it. They admit repeated visits; *e.g.* Trifolium, Onobrychis. (2) P. whose essential organs are confined under tension and explode. In these only one insect's visit is effective; *e.g.* Medicago, Genista, Ulex. (3) P. with a piston mechanism which squeezes the pollen in small quantities out of the apex of the carina, and not only permits but requires numerous insect visits; *e.g.* Lotus, Ononis, Lupinus. (4) P. with a brush of hairs upon the style which sweeps the pollen in small portions out of the apex of the carina. They for the most part require repeated insect visits; *e.g.* Lathyrus, Vicia." (Müller.) Cleistogamy is fairly common in the order. In several cases the stigma in the unvisited flr. lies in the keel among the pollen, but it has been shown that it only becomes receptive (if young) when rubbed, so that autogamy does not necessarily occur in these cases. The first visitor will rub the stigma and autogamy will of course occur then, but if there were any other pollen on the insect, a cross will happen. For the peculiar phenomenon of *enantiostyly* (right- and left-styled flrs.) see Cassia. Some sp. have flrs. which after fertilisation bury themselves in the earth and there ripen their fruit; *e.g.* Arachis, Voandzeia, Trifolium, Vicia, Lathyrus, &c.

The fruit of the L. is typically a *legume* or pod opening by both sutures. In some the pod is constricted between the seeds, forming a *lomentum* which breaks up into indehiscent one-seeded portions. The pods frequently open explosively, the valves twisting up spirally, *e.g.* in Ulex, Cytisus sp., &c. In Colutea, &c. the pods are inflated and so catch the wind. Others are winged. Some are eaten by animals, but the seed-coats are hard enough to preserve the seeds from injury. Some have a coloured fleshy aril (Acacia sp., &c.). Still others have hooked pods, *e.g.* Medicago, Mimosa. [See Buchwald in Engler's *Bot. Jahrb.* XIX. 1894.]

The seed is exalbuminous and contains as a rule a very large store of reserve-materials in the cotyledons. This is of great importance to the young plant (p. 113), and in this respect the L. are better provided than most other families.

Economically the L. is a most important order. The seeds of many sp. form important food-stuffs, *e.g.* of Arachis, Cajanus, Cicer, Dolichos, Glycine, Lathyrus, Lens, Lotus, Lupinus, Phaseolus, Pisum, Vicia, Voandzeia, &c. The pods of Ceratonia, Tamarindus, Phaseolus, Prosopis, &c. are also eaten. A great number are valuable as fodder plants, *e.g.* Trifolium, Medicago, Onobrychis, Lotus, Vicia, &c. Many tropical sp. yield valuable timber; Crotalaria and others



are sources of fibre; Haematoxylon, Genista, Indigofera, Acacia, &c. yield dyes; gums and resins are obtained from Acacia, Copaifera, Astragalus, Hymenaea, &c.; oil is expressed from the seeds of *Arachis* and *Voandzeia*; kino is obtained from *Pterocarpus*, and so on. See Chap. iv. and genera.

*Classification and chief genera* (after Taubert): the L. are nearly related to Rosaceae (especially Chrysobalanaceae) and Connaraceae. Benth.-Hooker place them in Rosales, Warming erects L. into a separate cohort, and considers each of the three chief sub-orders as an independent order.

The primary division is:

- I. *MIMOSOIDEAE*. Flrs. regular, corolla valvate.
- II. *CAESALPINIOIDEAE*. Zygomorphic; corolla-aestivation imbricate ascending.
- III. *PAPILIONATAE*. Zygomorphic papilionaceous; corolla-aestivation imbricate descending.

These are again subdivided: the following key enables one to ascertain to which of the subdivisions any Leguminous plant belongs.

#### I. *MIMOSOIDEAE*.

##### A. Calyx valvate.

##### a. Sta. more than 10.

1. *Ingeae* (sta. united): Inga, Calliandra.
2. *Acacieae* (sta. free): Acacia (only gen.).
- b. Sta. twice as many as petals.
3. *Eumimoseae* (anther glandless): Mimosa.
4. *Adenanthereae* (anther in bud crowned by a gland; endosperm): Neptunia, Prosopis.
5. *Piptadenieae* (ditto, no endosperm): Piptadenia.

##### B. Calyx imbricate.

6. *Parkieae*: Parkia.

#### II. *CAESALPINIOIDEAE*.

##### A. Calyx in bud quite undivided or tubular below.

##### a. Leaves simple or one pair of leaflets. Sta. 10 or fewer.

4. *Bauhinieae*: Bauhinia, Cercis.

##### b. Leaves once pinnate (exceptions). Sta. $\infty$ or rarely 9—13.

9. *Toumateae*: Tounatea.

##### c. Leaves bipinnate, or once pinnate; sta. 5.

1. *Dimorphandreeae*: Dimorphandra.

##### B. Calyx in bud quite polysepalous or very nearly so.

- a. Two anterior petals modified to large glands, anthers opening by pores.

6. *Kramerieae*: Krameria.

##### b. Two anterior petals developed or not, but not glandular.

- a. Leaves some or all bipinnate.

7. *Eucaesalpinieae*: Caesalpinia, Haematoxylon, Gleditschia.

β. Leaves once pinnate.

5. *Cassieae* (anthers basifixed, opening by terminal pores):  
Cassia, Ceratonia.
3. *Amherstieae* (dorsifixed, no pores; ovary adnate behind to  
torus): Hymenaea, Tamarindus.
8. *Sclerolobieae* (ovary free, ovules more than 3).
2. *Cynometreae* (ovules 1 or 2): Copaiba.

III. *PAPILIONATAE*.

A. Sta. free.

1. *Sophoreae* (pinnate leaf): Sophora, Toluifera.
2. *Podalyrieae* (simple or palmate): Anagyris.

B. Sta. united.

a. Lomentum.

7. *Hedysareae*: Coronilla, Onobrychis, Arachis, Desmodium.

b. Legume or indehiscent pod.

a. Leaves absent.

6. *Galegae*: Amorpha, Robinia, Colutea.

β. Leaves present.

1. *Leaf or leaflets without stipels*.

(1) Lf. simple or palmate.

- \* Lf. with 3 entire leaflets.

3. *Genisteae*: (shrubs) Genista, Lupinus, Ulex, Cytisus.

6. *Galegae*: (herbs) as above.

- \*\* Lf. with 5 entire leaflets.

5. *Loteae*: Anthyllis, Lotus.

- \*\*\* Lf. with 3 toothed leaflets.

4. *Trifolieae*: Ononis, Medicago, Trifolium.

(2) Leaf pinnate.

- \* Leaf-stalk ending in bristle or tendril.

9. *Vicieae*: Abrus, Vicia, Lathyrus.

- \*\* Leaf-stalk not ending so.

- † Pod dehiscing in 2 valves.

- § Sta. filamentous.

10. *Phaseoleae*: (ovary surrounded by disc) Apios, Phaseolus.

6. *Galegae*: (no disc) as before.

- §§ Some or all sta. broadened at apex.

5. *Loteae*: as before.

- †† Pod indehiscent.

8. *Dalbergieae*: Dalbergia, Pterocarpus.

II. *Leaves or leaflets with stipels*.

10. *Phaseoleae*: (pod dehiscient) as before.

8. *Dalbergieae*: (pod indehiscent) as before.

**Leitneria** Chapm. Leitneriaceae. 2 sp. N. Am.

**Leitneriaceae.** Dicotyledons (Archichl. Juglandales). Only genus

**Leitneria.** Shrubs with spikes of dioecious flrs. ♂ flr. naked with 3—12 sta. ♀ with scaly perianth and 1 cpl. and long style. Ovary 1-loc., with 1 amphitropous ovule. Fruit drupaceous. Seed albuminous. Embryo straight. Placed in Unisexuales by Benth.-Hooker.

**Leitnerieae** (Benth.-Hooker) = Leitneriaceae.

**Lemna** Linn. Lemnaceae. 6 sp. cosmop.; 4 in Brit. (duckweed).

The plant consists in most sp., e.g. *L. minor* L., of a flat green blade, floating upon the water; this is the stem, which performs leaf-functions. From the under side hangs down a long adventitious root, with a well-marked root-cap. There are no leaves. The stems are oval and slightly turned up at the ends, so that if two are placed near together in water, they will run against one another and adhere by the tips. In the posterior portion on either side is a groove under the edge. In this arise branches which may either (as in *L. trisulca* L., &c.) remain in union with the parent shoot, or become detached and give rise to new plants. In autumn a number of these are formed ready to start growth in the next spring, whilst the mother plants sink to the bottom. The flrs. are also borne in these grooves. There is a very reduced spathe, with 2 male flrs. (each reduced to 1 sta.) and 1 female (1 cpl.).

**Lemnaceae.** Monocotyledons (Spathiflorae). 3 gen. with 18 sp. of free-swimming perennial water-plants with no leaves. The description of *Lemna* applies to the other genera also. Flrs. unisexual, monoecious; ♂ of 1 sta., ♀ of 1 cpl., with 1—6 basal, erect, ortho- to ana-tropous ovules. The micropylar end of the inner integument forms a kind of lid upon the seed. Endosperm slight. The L. are regarded as very reduced Araceae (q.v.). Benth.-Hooker place them in Nudiflorae, Warming in Spadiciflorae. *Genera*: Spirodela, *Lemna*, *Wolffia*. See *Nat. Pfl.* for full details.

**Lennoaceae.** Dicotyledons (Sympet. Ericales). A small order (3 gen. 5 sp.) of S. Californian and Mexican plants, parasitic by their roots on roots of *Clematis*, &c. For details see Drude in *Nat. Pfl.* *Genera*: *Pholisma*, *Ammobroma*, *Lennoa*.

**Lens** (Tourn.) Linn. Leguminosae (III. 9). 6 sp. Medit., W. As. *L. esculenta* Moench (*Ervum Lens* L.) is the lentil, a food-plant of great antiquity. The seeds furnish a flour which is often sold at high prices as food for infants &c. under fancy names.

**Lentibulariaceae.** Dicotyledons (Sympet. Tubiflorae). 5 gen. with 250 sp. cosmop. All belong to the group of insectivorous plants and show many interesting features in their vegetative organs; for details see p. 195 and genera. The infl. is usually a raceme or spike; flrs. solitary in *Pinguicula* &c. Flr. ♂, zygomorphic, 5-merous. K 2—5-lobed, the odd sepal posterior, often 2-lipped, persistent on the fruit; C (5), 2-lipped, the lower lip more or less spurred; A 2 (the anterior pair), epipetalous, with 1-loc. anthers; G (2) 1-loc. with free-central placenta and sessile 2-lobed stigma (the posterior lobe abortive);

ovules  $\infty$  or 2, anatropous, often more or less sunk in the placenta. Capsule with  $\infty$  seeds, opening by 2—4 valves, or with 1 seed indehiscent. Seed exalbuminous. *Genera*: Pinguicula, Genlisea, Polypompholyx, Utricularia, Biovularia. Placed in Personales by Benth.-Hooker, in Personatae by Warming. [See *Nat. Pfl.* and literature of Insectivorous plants (p. 205) for details.]

**Leonotis** R. Br. Labiatae (vi. 4). 12 sp. trop. and S. Afr.

**Leontice** Linn. Berberidaceae. 12 sp. N. temp. The base of the stem is tuberous.

**Leontodon** Linn. (incl. *Thrinia* Roth). Compositae (xiii). 45 sp. temp., Eur., As.; 3 in Brit. (hawkbit). Very like *Taraxacum*. In *L. hirtus* L. the outer fruits have no pappus.

**Leontopodium** R. Br. Compositae (iv). 4 sp. Mts. of Eur., As. and S. Am. *L. alpinum* Cass. is the Edelweiss. It is a xerophyte growing in dense tufts, and covered with woolly hairs. The heads of fls. are small, but are massed together and surrounded by hairy bracts which add to their conspicuousness. The central florets are male, the style remaining, however, to act as pollen-presenter, though it has no stigmas. The outer florets are female.

**Leonurus** Linn. Labiatae (vi. 4). 8 sp. Eur., As., and trop. *L. Cardaca* L. in Brit. (mother-wort).

**Leopoldinia** Mart. Palmae (iv. 6). 4 sp. trop. Brazil. *L. Piassaba* Wallace yields the best Piassaba fibre (Wallace, *Amazon*, ch. ix.).

**Lepachys** Rafin. Compositae (v). 4 sp. N. Am. Included in *Rudbeckia* in *Nat. Pfl.*

**Lepidium** Linn. Cruciferae (ii. 5). 100 sp. cosmop. 5 in Brit. (cress). *L. sativum* L. (Orient) is the garden cress.

**Lepidocaryum** Mart. Palmae (iii. 4). 5 sp. Brazil.

**Lepidosperma** Labill. Cyperaceae (ii). 40 sp. Austr., N. Z., trop. As. *L. gladiatum* Labill. is the sword-sedge, used to bind sand-dunes in Austr., and as a material for paper-making.

**Lepigonum** Wahlb. = *Spergularia* J. et C. Presl.

**Lepironia** Rich. Cyperaceae (ii). 1 sp., *L. mucronata* Rich., Madag., trop. As., Austr., Polynes., largely cultivated in China. The stems are beaten flat and woven into mats, sails (for junks), &c.

**Leptospermum** Forst. Myrtaceae (2). 25 sp. Malaya, Austr., N. Z.

**Leptosporangiatæ** (Filicineae). See Filicineae *Leptosporangiatæ*.

**Leptotes** Lindl. = *Tetramicra* Lindl.

**Leschenaultia** R. Br. Goodeniaceae. 16 sp. Austr. "In *L. formosa* R. Br., the insect's proboscis comes in contact with the lower lip of the pollen-cup (see order), thus opening it and dusting itself with pollen; in the next flower it places this pollen on the stigmatic surface which lies outside the pollen-cup." (Müller.)

**Lespedeza** Michx. Leguminosae (iii. 7). 33 sp. temp. N. Am., As., and in Mts. of trop. As., Austr. The fls. are sometimes apetalous, and cleistogamic. *L. striata* Hook. et Arn., an Asiatic sp., is being

spread over N. Am. very rapidly by animal agency (p. 151). It is a useful fodder-plant.

**Lesquerella** Wats. = *Vesicaria* Tourn.

**Lessertia** DC. Leguminosae (III. 6). 40 sp. Afr.

**Leucadendron** Berg. Proteaceae (I). 70 sp. S. Afr. *L. argenteum* R. Br., the silver-tree, is well known; its leaves are covered with fine silky hairs, and may even be used for painting upon. It has been nearly extirpated by being largely used for firewood. Flr. like that of *Protea*. The perianth, when the fruit is ripe, splits into 4 segments, united together round the stigma, and acts as a wing for the fruit.

**Leucanthemum** (Tourn.) Linn. = *Chrysanthemum* Tourn.

**Leucas** Burm. Labiatae (VI. 4). 60 sp. trop., Afr., As.

**Leuceria** Lag. Compositae (XII). 50 sp. S. Am. Xerophytes.

**Leuchtenbergia** Fisch. et Hook. Cactaceae (I). 1 sp. Mexico. See order.

**Leucocoryne** Lindl. Liliaceae (IV). 3 sp. Chili.

**Leucojum** Linn. Amaryllidaceae (I). 10 sp. S. Eur. (snow-flake).

**Leucopogon** R. Br. Epacridaceae. 130 sp. Austr., Malaya. Included in *Styphelia* Sol. in *Nat. Pl.*

**Leucospermum** R. Br. Proteaceae (I). 20 sp. Afr.

**Leucothoe** D. Don. Ericaceae (II. 4). 32 sp. Am. Like *Andromeda*.

**Levenhookia** R. Br. Candolleaceae. 7 sp. Austr. The labellum is shoe-shaped and at first embraces the column, but if touched it springs downwards.

**Lewisticum** Riv. ex Linn. Umbelliferae (6). 1 sp. Eur.

**Lewisia** Pursh. Portulacaceae. 2 sp. California. *L. rediviva* Pursh (bitter-root) with its thick rhizome, fleshy roots and leaves, is one of the most xerophytic plants known. Two years' drying will hardly kill it. K 4—8, C 8—16; sta. numerous.

**Leycesteria** Wall. Caprifoliaceae (IV). 3 sp. Himalaya.

**Liabum** Adans. Compositae (VIII). 40 sp. Am. and W. Ind.

**Liatris** Schreb. Compositae (II). 15 sp. N. Am.

**Libertia** Spreng. Iridaceae (II). 8 sp. Chili, Austr., N. Z.

**Libocedrus** Endl. Coniferae (Arauc. 2 b; see C. for genus characters). 8 sp., 2 in Chili, 2 in N. Z., 1 each in New Caled., Japan, China, Calif. *L. Doniana* Endl. (N. Z.), *L. tetragona* Endl. (Chili) and *L. decurrens* Torr. (Calif.—the white cedar) yield valuable timber.

**Licania** Aubl. Rosaceae (VI. 13). 36 sp. S. Am.

**Licuala** Thunb. Palmae (I. 2). 36 sp. Indo-mal.

**Ligularia** Cass. = *Senecio* Tourn.

**Ligusticum** Linn. Umbelliferae (6). 25 sp. N. Hemisph. *L. scoticum* L. (lovage) occurs in Brit.; it is sometimes used as a pot-herb.

**Ligustrum** (Tourn.) Linn. Oleaceae (I. 3). 35 sp., esp. E. As. In Eur. (incl. Brit.) *L. vulgare* L., the privet, is common.

**Liliaceae**. Monocotyledons (Liliiflorae). One of the largest families

of flowering plants; 200 gen. with 2500 sp., cosmop. The smaller groups of the order are often confined to definite floral regions. Most are herbs with sympodial rhizomes or bulbs; a few trop. and warm temp. forms, *e.g.* *Yucca*, *Dracaena*, &c., are shrubs or trees, often with an unusual mode of growth in thickness of the stem. Many are xerophytes; some, *e.g.* *Aloe* and *Gasteria*, are succulent; others, *e.g.* *Phormium*, have hard isobilateral leaves; others, *e.g.* *Dasyllirion*, have tuberous stems and narrow leaves with reduced transpiration; *Bowiea* only produces leafy shoots in the wet season, and so on. *Smilax*, *Gloriosa*, &c. are climbing plants, the former with peculiar stipular tendrils. *Ruscus* exhibits phylloclades.

The infl. is most commonly of racemose construction, and the flrs. have no bracteoles; when the latter occur, the further branching from their axils usually takes a cymose form, especially that of a bostryx (p. 53), as *e.g.* in *Hemerocallis*. The apparent umbels or heads of *Allium*, *Agapanthus*, &c. are really cymose (p. 53). Solitary terminal flrs. occur in tulip, &c. The flrs. are usually ♂, regular, pentacyclic, 3-merous (rarely 2, 4, or 5), hypogynous.  $P\ 3+3$ , free or united, petaloid or sometimes sepaloid;  $A\ 3+3$  or fewer, rarely more, usually with introrse anthers;  $G\ (3)$  usually superior, rarely inferior or semi-inferior, 3-loc. with axile, or rarely 1-loc. with parietal placentae; ovules usually  $\infty$ , in two rows in each loc., anatropous. Fruit usually capsular, loculicidal or septicidal, sometimes a berry. Seed with straight or curved embryo, in abundant fleshy or cartilaginous, never floury, endosperm.

The flrs. are usually insect-pollinated. Honey is often (*e.g.* in *Scilla*, *Allium*, &c.) secreted by glands in the ovary-wall between the cpls.; in other cases by glands on the bases of the perianth-leaves (see Müller's *Fert. of Flrs.* and *Alpenblumen* for general account of L.). *Yucca* (q.v.) has a unique pollination-method. The seed-dispersal mechanisms, with the exception of the few cases of fleshy fruits, are of low type.

Economically the L. are of no great value. The chief food plants are *Allium* and *Asparagus*; *Phormium*. *Yucca*, and *Sansevieria* yield useful fibre; *Smilax*, *Urginea*, *Aloe*, *Colchicum*, *Veratrum*, &c., are medicinal. *Xanthorrhoea* and *Dracaena* yield resins; *Chlorogalum* is used as soap. Many are favourite garden and greenhouse plants, *e.g.* *Convallaria*, *Tulipa*, *Fritillaria*, *Lilium*, *Agapanthus*, *Kniphofia*, *Funkia*, *Hyacinthus*, *Gloriosa*, and many more.

*Classification and chief genera* (after Engler): the L. are closely allied to Juncaceae; usually they can be distinguished by their petaloid perianth, that of J. being sepaloid, but many L. have a sepaloid perianth, *e.g.* *Xanthorrhoea*, *Kingia*, &c., and in these cases almost the only distinction is the absence in L. of the long thread-like twisted stigmas of J. Benth.-Hooker unite the genera mentioned, and some others, to Juncaceae, and they place sub-orders VIII and IX

in Haemodoraceae. Warming splits up the family into Colchicaceae, Liliaceae, and Convallariaceae.

I. *MELANTHIOIDEAE* (rhizome, or bulb covered with scale-leaves and with terminal infl.; anthers extrorse or introrse; capsule loculicidal or septicidal; fruit never a berry): *Tofieldia*, *Narthecium*, *Veratrum*, *Gloriosa*, *Colchicum*.

II. *HERRERIOIDEAE* (tuber, giving off climbing stem; leaves in tufts; small-flowered racemes at the base of these or in panicles at ends of twigs; septicidal capsule): *Herreria* (only genus).

III. *ASPHODELOIDEAE* (rhizome with radical leaves, rarely stem with crown of leaves or leafy branched stem or bulb; infl. usually terminal, a simple or compound raceme or spike; P or (P); anthers introrse; capsule, rarely berry): *Asphodelus*, *Chlorogalum*, *Bowiea*, *Funkia*, *Hemerocallis*, *Phormium*, *Kniphofia*, *Aloe*, *Gasteria*, *Ha worthia*, *Aphyllanthes*, *Lomandra*, *Xanthorrhoea*, *Kingia*.

IV. *ALLIOIDEAE* (bulb or short rhizome; cymose umbel  $\pm$  enclosed by two broad or rarely narrow leaves, sometimes joined; infl. rarely of 1 flr.): *Agapanthus*, *Gagea*, *Allium*, *Brodiaea*.

V. *LILIOIDEAE* (bulb; infl. terminal, racemose; P or (P); anthers introrse; capsule loculicidal, except in *Calochortus*): *Lilium*, *Fritillaria*, *Tulipa*, *Urginea*, *Galtonia*, *Scilla*, *Ornithogalum*, *Hya cinthus*, *Muscari*.

VI. *DRACAENOIDEAE* (stem erect with leafy crown, except in *Astelia*; leaves sometimes leathery, never fleshy; P free or united at base; anthers introrse; berry or capsule): *Yucca*, *Dasyliiron*, *Dracaena*.

VII. *ASPARAGOIDEAE* (rhizome subterranean, sympodial; berry): *Asparagus*, *Ruscus*, *Polygonatum*, *Convallaria*, *Paris*, *Tril lium*.

VIII. *OPHIPOGONOIDEAE* (short rhizome, sometimes with suckers, with narrow or lanceolate radical leaves; P or (P); anthers introrse or semi-introrse; ovary sup. or  $\frac{1}{2}$ -inf.; fruit with thin pericarp and 1—3 seeds with fleshy coats): *Sansevieria*, *Ophiopogon*.

IX. *ALETROIDEAE* (short rhizome with narrow or lanceo late radical leaves; (P); anthers semi-introrse; capsule loculicidal; seeds  $\infty$ , with thin testa): *Aletris* (only genus).

X. *LUZURIAGOIDEAE* (shrubs or undershrubs with erect or climbing twigs; infl.-twigs usually many-flowered, cymose, rarely 1-flowered, with scaly bract at base; both whorls of P. alike or not; berry with spherical seeds): *Luzuriaga*, *Lapageria*.

XI. *SMILACOIDEAE* (climbing shrubs with net-veined leaves; flrs. small in axillary umbels or racemes or terminal panicles; loc. with 1 or 2 orthotropous or semi-anatropous ovules): *Smilax*.

[Placed in Coronarieae by Benth.-Hooker, in *Liliiflorae* by Warming.]

**Liliiflorae.** The 8th cohort (Engler) of Monocotyledons (p. 135). The 5th cohort (Warming) of Monocotyledons (p. 146).

**Lilium** Tourn. ex Linn. Liliaceae (v). 45 sp. N. temp. Herbs with scaly bulbs (p. 162), leafy stems and flrs. in racemes. The honey is secreted in long grooves at the bases of the perianth-leaves. The flrs. of many sp. are adapted to Lepidoptera. *L. Martagon* L. gives off its scent at night (cf. *Oenothera*). *L. bulbiferum* L. is reproduced vegetatively by bulbils in the leaf-axils. In most sp. with hanging flrs the capsule when ripe stands vertically upwards, so that the seeds can only escape when it is shaken. Many sp. of lily are garden favourites.

**Limnanthaceae.** Dicotyledons (Archichl. Sapindales). A very small order (2 gen. with 5 sp. N. Am.) sometimes united to Geraniaceae, but with the ovules as in coh. Sapindales. Herbs with exstip. alt. leaves and regular ♂ flrs., 3—5-merous, with two whorls of sta. Ovary 3—5-loc., ovules 1 in each loc., ascending, the micropyle facing outwards and downwards. Fruit a schizocarp. Seeds exalbuminous. *Genera:* *Limnanthes*, *Floerkea*. Placed in Geraniaceae by Benth.-Hooker, in Grinales by Warming.

**Limnathemum** S. P. Gmel. Gentianaceae (II). 20 sp. trop. and temp. *L. (Villarsia) nymphaeoides* Hoffmgg. et Link, S. England, is a water-plant with habit of *Nymphaea*, and so are several others. The infl. appears to spring from the top of the leaf-stalk, but really the floating leaf springs from the infl. axis. As Goebel points out, this is an advance upon the *Nymphaea* construction, as the materials going from leaf to seeds have not to travel to the bottom of the pond and up again.

**Limnanthes** R. Br. Limnanthaceae. 4 sp. Pacific N. Am.

**Limnobium** Rich. (*Hydromystria* G. F. W. Mey., *Trianea* Karst.). Hydrocharitaceae. 3 sp. Am. *L. (H.) stoloniferum* Griseb. (*T. bogotensis* Karst.) is a small floating plant often cultivated. It reproduces vegetatively by 'runners' (cf. *Hydrocharis*). Its root-hairs are used to show circulation of protoplasm. Only the ♀ plant is known in Eur.

**Limncharis** Humb. et Bonpl. Butomaceae. 1 sp. trop. Am. [*L. Humboldtii* Rich. = *Hydrocleys Commersonii* Rich.]

**Limnorum** (Tourn.) Linn. Orchidaceae (4). 1 sp. S. Eur. A leafless saprophyte with no chlorophyll (cf. *Epipogon*). The 4 lateral sta. are sometimes fertile.

**Limonia** Linn. Rutaceae (x). 6 sp. trop. Afr. and As. Some sp. in the leaf-axils have thorns (leaves of branch, as in *Cactaceae*). The fruit of *L. acidissima* L. is used in Japan as a substitute for soap.

**Limoniastrum** Moench. Plumbaginaceae. 3 sp. Medit.

**Limosella** Linn. Scrophulariaceae (II. 8). 7 sp. cosmop. *L. aquatica* L., mud-wort, in Brit. (rare), a small plant growing on the banks of ponds. It multiplies by runners.



**Linaceae.** Dicotyledons (Archichl. Geraniales). 9 gen. with 120 sp., cosmop. Most are herbs and shrubs with alt. entire often stip. leaves. Infl. cymose, a dichasium or cincinnus, the latter usually straightening out very much and looking like a raceme (p. 53). Flr. ♂, regular, usually 5-merous. K 5, quincuncial; C 5, imbricate or convolute; A 5, 10 or more, often with staminodes, united at base into a ring; G (2—3—5), multi-loc., often with extra partitions projecting from the midribs of the cpls., but not united to the axile placentae; ovules 1 or 2 per loc., pendulous, anatropous, with the micropyle facing outwards and upwards. Septicidal capsule, or drupe. Embryo usually straight, in fleshy endosperm. *Linum* (flax, linseed) is economically important. • *Chief genera:* *Radiola*, *Linum*, *Hugonia*. [Placed in Geraniales by Benth.-Hooker (who unite *Erythroxylaceae* to L.), in Grinales by Warming.]

**Linaria** Tourn. ex Mill. (incl. *Cymbalaria* Medic., *Elatine* Rupp., *Elatinoidea* Wettst.). Scrophulariaceae (II. 5). 125 sp. N. Hemisph. and S. Am., chiefly extra-trop. 7 in Brit. (toad-flax): *L. vulgaris* Mill. is the commonest (yellow toad-flax). The plant is a perennial, each year's growth arising from an adventitious bud upon the summit of the root. The flr. is closed at the mouth; honey is secreted by the nectary at the base of the ovary and collects in the spur. The only visitors are the larger bees, which are able to open the flr., and whose tongues are long enough to reach the honey. Peloria of the flr. is frequently observed; a terminal flr. appears upon the raceme and is symmetrical in structure, with 5 spurs upon the corolla and a tubular mouth. Sometimes flrs. of this type occur all down the raceme. Another interesting sp. is *L. Cymbalaria* Mill., the ivy-leaved toad-flax, found on walls in many parts of Brit. Before fertilisation the flrs. are positively heliotropic and stand erect; after it they become negatively heliotropic and bend downwards, seeking out the dark crannies in the substratum, where the seeds ripen.

**Lindelofia** Lehm. Boraginaceae (IV. 1). 2 sp. Himal.

**Lindera** Thunb. Lauraceae (II). 60 sp. Japan to Java and N. Am. *L. Benzoin* Meissn. has aromatic bark (antifebrile).

**Lindernia** All. = *Vandellia* Linn.

**Lindhelmera** A. Gray et Engelm. Compositae (v). 1 sp. Texas.

**Lindsaya** Dryand. Polypodiaceae. 50 sp. chiefly trop.

**Lineae** (Benth.-Hooker) = *Linaceae*.

**Linnaea** Gronov. (excl. *Abelia* R. Br.) Caprifoliaceae (III). 1 sp. Eur. N. Am., *L. borealis* L., which occurs in a few localities in Scotland. The ovary is covered with glandular hairs. Sta. 4, didynamous. Two loculi are ∞-ovulate and sterile, the other 1-ovulate and fertile.

**Linociera** Sw. (*Mayepea* Aubl.). Oleaceae (I. 3). 50 sp. trop.

**Linum** Tourn. ex Linn. Linaceae. 90 sp. temp. and sub-trop., esp. Medit. 4 in Brit., of which *L. catharticum* L. (purging flax) is common, while *L. usitatissimum* L. (common flax or linseed) is an

introduction, it being very largely cultivated in Ireland and elsewhere. The fls. are in sympodial cincinni. Several sp. are heterostyled (dimorphic), e.g. the common red one of gardens, *L. grandiflorum* Desf. Illegitimate pollination in this species produces absolutely no seed at all (p. 88). The seed has a mucilaginous testa which swells on wetting (p. 105).

Flax is the fibre of *Linum usitatissimum* L., obtained by rotting off the softer tissues in water. The seeds (linseed) yield an oil by pressure, and the remaining 'cake' (cf. *Gossypium*) is used for cattle-feeding, &c.

**Liparis** Rich. (incl. *Cestichus* Thou.). Orchidaceae (8). 100 sp. trop. and temp. (1 in Brit., rare).

**Lippia** Houst. ex Linn. Verbenaceae (11). 100 sp. trop. Am., Afr. The leaves of *L. citriodora* H. B. et K. yield an aromatic oil used in perfumery under the name Verbena-oil. Some sp. have axillary thorns.

**Liquidambar** Linn. Hamamelidaceae. 4 sp. As., N. Am. Fls. monœcious, apetalous, the male in upright spikes, the female in heads on pendulous stalks. The seeds are easily shaken out in strong winds. Storax (a fragrant balsam) is obtained from all the sp., but chiefly from *L. orientalis* Mill. (As. min.). *L. styraciflua* L. is the Sweet Gum of N. Am. Its wood is useful.

**Liriodendron** Linn. Magnoliaceae (1). 1 sp. N. Am., *L. tulipifera* L., the tulip-tree, often cultivated in parks for its handsome fls. The leaf is polymorphic (*Bot. Jahresh.* 1890, p. 414). The fruit is a samara; the aggregate of samaras upon the receptacle looks much like a pine-cone. The wood is very useful.

**Lisianthus** Linn. Gentianaceae (1. 2). 10 sp. W. Ind., Cent. Am.

**Lissochilus** R. Br. Orchidaceae (16). 30 sp. trop. Afr.

**Listera** R. Br. Orchidaceae (4). 10 sp. N. temp. *L. ovata* R. Br. (tway-blade) and *L. cordata* R. Br. in Brit. The labellum is bent downwards and forked into two. The rostellum on being touched ruptures violently and ejects a viscid fluid which cements the pollinia to the insect as in Epipactis (see Darwin, *Orchids* p. 115).

**Litchi** Sonner. Sapindaceae (1). 1 sp. China, *L. chinensis* Sonner., the Litchi or Leechee, largely cultivated for its edible fruit, a nut containing one seed surrounded by a fleshy aril. [Included in *Nephelium* (q.v.) by Benth.-Hooker.]

**Lithophragma** Torr. et Gray = *Tellima* R. Br.

**Lithospermum** (Tourn.) Linn. Boraginaceae (1v. 4). 40 sp. temp.; 3 in Brit. (gromwell.).

**Litsea** Lam. Lauraceae (11). 100 sp. trop. As. Austr.

**Littonia** Hook. Liliaceae (1). 2 sp. S. Afr. Like *Gloriosa*.

**Littorella** Berg. Plantaginaceae. 2 sp., 1 in S. Am., and *L. lacustris* L. (shore-weed) in Eur. (incl. Brit.). This plant exhibits two forms, one in water, another on land (p. 173). The land form has a rosette of narrow leaves about 3 cm. long, which spread out upon the ground

and show distinct dorsiventral structure. The flrs. are borne in groups of 3, one ♂ on a long stalk between two sessile ♀ flrs. The stigmas of the latter are ripe before the sta. emerge from the former. Both sta. and style are very long and the flrs. are wind-pollinated. Fruit a nut. The water form has much larger leaves which grow erect and are cylindrical (centric) in form and internal structure; no flrs. are produced, but the plant multiplies largely by the formation of runners. It is common on the shores of lakes in Brit. and is often mistaken for Isoetes.

**Livistona** R. Br. Palmae (1. 2). 12 sp. Indo-mal., Austr. Tall trees with fan leaves and panicles of ♂ flrs. Fruit a berry.

**Lloydia** Salisb. Liliaceae (v). 5 sp. N. temp. *L. serotina* Sweet (*L. alpina* Salisb.) on Snowdon. See Muller's *Alpenblumen*.

**Loasa** Adans. Loasaceae. 81 sp. Mexico and S. Am., chiefly Mts. of Chili and Peru. Several sp. are cultivated for their handsome flrs.; they possess, however, stinging hairs. The flrs. are generally yellow and face downwards. The nectaries, formed of combined staminodes (see order), are large and conspicuous. The petals are boat-shaped and conceal the groups of sta. The flrs. are visited by many insects. *L. triloba* Juss. has, according to Gilg, cleistogamic flrs. on the lower branches.

**Loasaceae.** Dicotyledons (Archichl. Parietales). 13 gen. with 120 sp. Andine plants, many of which are favourites in gardens. They are mostly herbs, frequently twining, with opp. or alt., rarely stip., leaves. The epidermis bears hairs of various kinds; especially common are grapple-hairs and stinging-hairs, the latter frequently rather formidable. The flrs. are usually in cymes, often sympodial, yellow (rarely white or red), ♂, usually 5-merous. The receptacle is deeply hollowed out, so that the flr. is epigynous. K 5, imbricate; C 5, free or united; A 5—∞. In the genera with ∞ sta. there is much difference as to the arrangement. In *Mentzelia* they are evenly distributed round the style, the outermost in some sp. being sterile. In other genera it is the ante-sepalous sta. that are sterile, and in some, e.g. *Loasa*, *Blumenbachia*, 3 or more of the staminodes are united to form a large coloured nectary, whose mouth is towards the centre of the flr. and partly obstructed by the other staminodes. Ovary inferior, of 1 or more commonly 3—5 cpls., with parietal placentation; ovules 1, several, or ∞, anatropous, with one integument; style simple. Fruit various, often a capsule, sometimes spirally twisted. Endosperm or not.

*Classification and chief genera (after Gilg):*

- I. **GRONOVIOIDEAE** (ovary of 1 cpl.): *Gronovia*.
- II. **MENTZELIOIDEAE** (> 1 cpl.; no staminodes, or at least not nectariferous scales): *Mentzelia*.
- III. **LOASOIDEAE** (> 1 cpl.; staminodes present, often united to form nectariferous scales): *Loasa*, *Blumenbachia*.

[Placed in Passiflorales by Benth.-Hooker, in Passiflorinae by Warming.]

**Loaseae** (Benth.-Hooker) = Loasaceae.

**Lobelia** Plum. ex Linn. Campanulaceae (III). 200 sp. trop. and temp.; 2 in Brit., one in lakes (*L. Dortmanna* L.). Several are commonly grown in gardens. The flr. (see order) is twisted upon its axis through 180°, and is zygomorphic. The anthers are syngeneisous as in Compositae and the style pushes through the tube thus formed, driving the pollen out at the top. Finally the style emerges, the stigmas separate, and the female stage begins. Not uncommonly the style is unable to push through the tube, or at least does not do so, and self-fertilisation occurs when the stigmas open. [See order, and compare Campanula, Phyteuma, Jasione and Compositae.]

**Lockhartia** Hook. Orchidaceae (28). 20 sp. trop. Am. No tubers; leaves crowded together.

**Lodoicea** Comm. Palmae (II. 3). 1 sp. *L. Sechellarum* Labill., Seychelles (p. 158), the double coco-nut or Coco de mer. Dioecious, with enormous spadices. The fruit is the largest known and takes 10 years to ripen. The nut is bilobed. The fruits used to be found floating in the Indian Ocean long before the tree was discovered (see *Treas. of Bot.*).

**Loeflingia** Linn. Caryophyllaceae (II. 3). 5 sp. Medit., Cent. As., N. Am.

**Logania** R. Br. Loganiaceae. 21 sp. Austr., N. Z.

**Loganiaceae**. Dicotyledons (Sympet. Contortae). 32 gen. with about 350 sp. of trop. plants. A few occur in warm temp. regions (Am., As., N. Z., but none in Eur.). They include trees, shrubs, and herbs with opp. stip. leaves; the stipules are often very much reduced. Many are climbing plants, of which *Strychnos* is especially interesting. The infl. is as a rule cymose, of very various types; the flrs. with bracts and bracteoles, usually regular, 8, and 4—5-merous, with occasional increase in number in corolla and androecium. Disc small or absent. K (4—5), imbricate; C (4—5), valvate, imbricate, or convolute; A 4—5, rarely 1, epipetalous;  $\bar{G}$  (2), anteroposterior, 2-loc., or rarely imperfectly so, or 1- or more-loc.; style simple; ovules usually  $\infty$ , amphi- or ana-tropous. Capsule, berry, or drupe. Endosperm. The L. are nearly allied to Apocynaceae, Gentianaceae, Solanaceae, Scrophulariaceae and Rubiaceae. See full discussion by Solereder in *Nat. Pfl.* Chief genera: *Logania*, *Spigelia*, *Strychnos*, *Fagraea*, *Buddleia*, *Desfontainea*. [Placed in Gentianales by Benth.-Hooker, in Contortae by Warming.]

**Loiseleuria** Desv. Ericaceae (I. 3). 1 sp. *L. procumbens* Desv. (*Azalea procumbens* L.), the trailing Azalea, north circumpolar. It is found in the Highlands of Scotland, where in parts the flat hill tops are carpeted with it (p. 192): The leaves are very wiry, and rolled back at the margins, thus protecting the stomata from too free transpiration. The

petioles of the topmost pair of open leaves are grooved and closely appressed to one another, thus protecting the bud. In its native habitat the plant lies close on the ground, but in gardens becomes erect in habit. The fls. are regular (this distinguishes *L.* from the true *Azalea*; see *A.* and classification of order); they are protogynous and come out very shortly after the melting of the snow. In Scotland they are self-pollinated, the sta. bending inwards to touch the stigma; this is not the case in the Alps.

**Lolium** Linn. Gramineae (xii). 6 sp. Eur., N. Afr., temp. As. *L. perenne* L. in Brit. (rye-grass). The spikelets are arranged in a 2-ranked spike, and placed edgewise (this distinguishes the sub-tribe *Lolieae* from the *Leptureae*, to which *Triticum* and *Hordeum* belong). The rye-grasses are valuable pasture and fodder grasses.

**Lomandra** Labill. (*Xerotes* R. Br.) Liliaceae (iii). 30 sp. Austr. Dioecious. Placed in Juncaceae by Benth.-Hooker.

**Lomaria** Willd. Polypodiaceae. 40 sp. cosmop., chiefly S. temp. *L. Spicant* Desv. (*Blechnum boreale* Sw.) is the hard-fern or northern fern, common on hills in Brit. There are fertile and barren leaves, the latter larger.

**Lomatia** R. Br. Proteaceae (ii). 9 sp. E. Austr., Tasm., Chili.

**Lomatophyllum** Willd. Liliaceae (iii). 3 sp. Mauritius, Bourbon (p. 158).

**Lonas** Adans. Compositae (vii). 1 sp. South-west Medit.

**Lonchitis** Linn. Polypodiaceae. 2 sp. S. Hemisph.

**Lonchocarpus** H. B. et K. Leguminosae (iii. 8). 60 sp. trop. Am. Afr. Austr.

**Lonicera** Linn. Caprifoliaceae (iv). 100 sp. N. Hemisph. *L. Periclymenum* L. (honeysuckle or woodbine), and others, in Brit. They are mostly erect shrubs, a few twining, with opp. frequently connate leaves. In the axils of the leaves are found in many sp. (e.g. *L. tatarica* L.) serial buds, of which the lowest gives rise to the fls. These are usually in pairs, the central fl. of the small dichasium not being developed. The flr. is frequently zygomorphic, and gives rise to a berry. In some sp. the pair of fls. produces two independent berries, in others the berries fuse into one as they form. Some sp. exhibit the 'fusion' even earlier; and one finds two corollas seated upon what at first glance appears a single inferior ovary. Dissection of this shows, however, that in most cases the two ovaries are side by side, free from one another, in a common hollow axis; in a few cases, however, the union is more complete. The flr. of the honeysuckle is visited chiefly by hawk-moths (at night). The flr. opens in the evening, the anthers having dehisced shortly before this. The style projects beyond the anthers. The flr. moves into a horizontal position at the same time. At first the style is bent downwards and the sta. form the alighting place for insects. Later on the style moves up to a horizontal position, the sta. shrivel and bend down, and this is com-

plete by the second evening when the next crop of buds is opening. At the same time the flr. has changed from white to yellow in colour. The length of the tube prevents any but very long-tongued insects from obtaining honey.

**Lopezia** Cav. Onagraceae (VII). 12 sp. Cent. Am. The flr. is zygomorphic. The two upper petals are bent upwards a little way from their base, and at the bend there seems to be a drop of honey. In reality this is a dry glossy piece of hard tissue; like the similar bodies in *Parnassia* it deceives flies. There are real nectaries however at the base of the flr. There are two sta., of which the posterior only is fertile; it is enclosed at first in the anterior one, which is a spoon-shaped petaloid staminode. In the early stage of the flr., while the style is still quite short and undeveloped, insects alight on the sta., later the style grows out into the place at first occupied by the sta., which now bends upwards out of the way. Self-fertilisation seems almost impossible. In *L. coronata* Andr. and other sp. there is an upward tension in the sta., a downward in the staminode, and an explosion occurs when an insect alights.

**Lophophytum** Schott et Endl. Balanophoraceae. 4 sp. trop. S. Am.

**Loranthaceae.** Dicotyledons (Archichl. Santalales). 21 gen., 520 sp. An extremely interesting order of parasitic plants, possessing green leaves (p. 194). The only genus in Brit. is *Viscum*, the mistletoe, but many others are found in the Tropics.

They are mostly semi-parasitic shrubs, attached to their host-plants by means of suckers or haustoria—usually regarded as modified adventitious roots. The stem is sympodial, often dichasial (e.g. *Viscum*), the leaves usually evergreen and of leathery texture. The infl. is cymose, the flrs. usually occurring in little groups of 3 (or 2, by abortion of the central flr.). In cases where the flrs. possess a stalk, the bract is united to this as far as the origin of the next branch (for details see *Viscum* and *Loranthus*). The receptacle is hollowed out, and the perianth springs from its margin. In the *Loranthoideae* there is below the perianth an outgrowth of the axis in the form of a small fringe—the *calyculus*—about whose morphology there has been some discussion. The perianth may be either sepaloïd or petaloïd. Flrs. ♂ or unisexual. Sta. as many as, and (as in *Proteaceae*) united with, the perianth-leaves. The pollen is often developed in a great number of loculi, separate from one another, though often becoming continuous when mature. Ovary 1-loc., sunk in, and united with, the receptacle, the ovules not differentiated from the placenta. Embryo-sacs more than one, curiously lengthened (cf. *Casuarina*). The fruit is a pseudo-berry or -drupe, the fleshy part being really the receptacle. Round the seed is a layer of viscin, a very sticky substance. [For full details of the many interesting features of this order, the infl., flr., pollen, development and structure of ovule and embryo-sac, fruit, seed, germination, haustoria, &c., see Engler in *Nat. Pfl.* and papers

by Wiesner in *Sitz. b. Akad. Wien*, CIII. 1894, and Keeble in *Trans. Linn. Soc.* v. 1896.]

*Classification and chief genera* (after Engler):

I. **LORANTHOIDEAE** (with calyculus): *Struthanthus*, *Loranthus*, *Psittacanthus*.

II. **VISCOIDEAE** (without calyc.): *Arceuthobium*, *Viscum*.

**Loranthus** Linn. Loranaceae (I). 200 sp. trop. Semi-parasites.

The ♂ or unisexual fls. are in small cymes, the bracts adnate to the peduncles. Fruit like that of *Viscum*. See *Nat. Pfl.*, Eichler's *Bluthendiag.* and papers by Wiesner and Keeble (see order).

**Lotononis** Eckl. et Zeyh. Leguminosae (III. 3). 60 sp. Afr., Medit.

**Lotus** (Tourn.) Linn. Leguminosae (III. 5). 80 sp. temp. Eur., As., S. Afr., Austr. *L. corniculatus* L., bird's foot trefoil, and others, in Brit. The floral mechanism is of interest, being typical of many of the order (q.v.). The keel is united above and below, leaving only a small opening at the apex. The pollen is shed in the bud into the tip of the keel, and the filaments of five of the sta. thicken out below the anthers, forming together a piston, which, when the keel is depressed, forces the pollen out in a little stream at the apex. The style is immersed in the pollen, but only becomes receptive on being rubbed, so that the flower has a good chance of cross-fertilisation. The plant is useful for pasturage.

**Lucuma** Molina (excl. *Vitellaria* Gaertn. f.). Sapotaceae (I). 4 sp. S. Am., Austr., New Caled. The fruit of *L. bifea* Molina is edible.

**Ludwigia** Linn. Onagraceae (I). 20 sp. N. Am. and trop.; also one (*L. palustris* Ell.) in Eur. (incl. Brit.).

**Luffa** (Tourn.) Linn. Cucurbitaceae (III). 7 sp. trop., all but one in Old World. *L. cylindrica* M. Roem. (*L. aegyptiaca* Mill.) furnishes the well-known loofah or bath sponge, which consists of the vascular bundle net of the pericarp. The fruit of most sp. is edible.

**Lunaria** Tourn. ex Linn. Cruciferae (II. 11). 2 sp. Eur., *L. rediviva* L. and *L. biennis* Moench (*L. annua* L.); the latter is the honesty of gardeners.

**Lupinus** (Tourn.) Linn. Leguminosae (III. 3). 100 sp. Am., Medit. Floral mechanism like that of *Lotus*. The fruit explodes, its valves twisting spirally. Several sp. of lupin are cultivated for their fls., or used as fodder plants.

**Luzula** DC. Juncaceae. 40 sp. temp., chiefly Old World; 6 in Brit. (wood-rush). Rhizome as in *Juncus*; leaves usually flat.

**Luzuriaga** Ruiz et Pav. (*Enargea* Banks). Liliaceae (x). 3 sp. S. Am., N. Z., &c.

**Lycaste** Lindl. Orchidaceae (18). 30 sp. trop. Am. Epiphytes. A chin is formed by an axial outgrowth from the base of the column.

**Lychnis** (Tourn.) Linn. (incl. *Agrostemma* Linn., *Githago* Adans., *Melandrium* Roehl., *Viscaria* Riv.). Caryophyllaceae (1. 1). A genus

of ill-defined limits, divided in *Nat. Pfl.* under several of the genera named. 40 sp. N. temp.; 6 in Brit., including *L. Flos-cuculi* L. (ragged robin), *L. dioica* L. (red campion), *L. Viscaria* L. (catch-fly) and *L. Githago* Scop. (corn-cockle). The flrs. are protandrous, and adapted to bees and Lepidoptera. The catch-fly gets its name from the glandular hairs upon the stalks. *L. dioica* is dioecious, and the female plant is much stouter and of coarser growth than the male (a parallel, but not a homologue, of the usual state of things in animals). The flrs. often show the sta. filled with a black or brown powder, instead of pollen; this consists of the spores of the fungus *Ustilago antherarum*, which are thus distributed from plant to plant, like pollen, by the visiting insects.

**Lycium** Linn. Solanaceae (II). 70 sp. temp. Many have thorny twigs; *L. afrum* L. (Kaffir thorn) is used for hedges in S. Afr. *L. barbarum* L. is often cultivated under the name tea-plant.

**Lycopersicum** Hill. Solanaceae (II). 10 sp. S. Am. *L. esculentum* Mill. (*Solanum Lycopersicum* L.) is the tomato or love-apple, cultivated for its fruit. Included in *Solanum* in *Nat. Pfl.*

**Lycopodiaceae.** Lycopodinae (Homosporous). 2 genera (*Lycopodium*, *Phylloglossum*) with 95 sp., trop. and temp. Of these all but one belong to *Lycopodium* itself. The fertilised ovum gives rise directly to the leafy plant; the embryo has a suspensor and a foot; and its upper part at first forms a tuber-like organ, the *protocorm*, from which the leaves and stem develop. In *P.* the stem is short and unbranched, in *L.* long and much branched, bearing small simple leaves, and roots developed in acropetal succession. The sporangia are axillary, and form as a rule a dense terminal cone or strobilus. The spores are all of one kind and give rise on germination to fairly large monœcious prothalli.

**Lycopodineae.** One of the main divisions of Pteridophyta. They are mostly leafy plants, with well developed stems and small unbranched leaves. The sporophylls are usually massed together into cones, recalling to mind those of the Gymnosperms. They are classified as follows.

A. Homosporous.

1. *Lycopodiaceae*: Roots present; sporangia simple, in axils of leaves which are more or less modified.
2. *Psilotaceae*: No roots; sporangia plurilocular, sunk in tissue of bilobed sporophylls.

B. Heterosporous.

3. *Selaginellaceae*: Stem long, leaves small; sporangia in leaf axils.
4. *Isoetaceae*: Stem tuberous, leaves awl-shaped, with sporangia sunk in their bases.

The position of order 4 is very doubtful, and it is often placed in Filicineae Eusporangiatæ.



**Lycopodium** Linn. Lycopodiaceae. 94 sp. trop. and temp. 5 occur in Brit., chiefly in mountain districts, where they are known as club-mosses. The commonest is *L. clavatum* L. (often called stag-horn moss); the others are *L. Selago* L., *L. alpinum* L., *L. annotinum* L., and *L. inundatum* L. All but the last are xerophytic evergreen plants with hard wiry leaves. The stem branches frequently, apparently dichotomously, but in reality usually in a monopodial manner. Upon it are borne the roots, which branch dichotomously, and are developed in acropetal succession. The leaves, narrow and unbranched, are usually placed spirally upon the stem, but in some sp. form four ranks, as in most Selaginellas. Many sp. have vegetative reproduction by aid of small bulbils developed in the leaf axils.

The sporangia are all alike in structure, containing spores of one kind only. They are placed upon the bases of leaves which are usually crowded together to form a terminal spike or strobilus. In *L. Selago* some or all of the sporangia are often replaced by small bulbils (cf. *Polygonum viviparum*, *Allium* sp., *Globba*, &c.).

**Lycopsis** Linn. Boraginaceae (IV. 3). 3 sp. Eur., As. *L. arvensis* L., small bugloss, in Brit.

**Lyopus** Tourn. ex Linn. Labiatae (VI. 11). 10 sp. N. temp. *L. europaeus* L., gipsywort, in Brit.

**Lygeum** Linn. Gramineae (VI). 1 sp. Medit. *L. Spartum* Loeff., one of the esparto-furnishing grasses (see *Stipa* and *Ampelodesma*).

**Lygodium** Sw. Schizaeaceae. 20 sp. trop. and temp. They are of interest as twining ferns. The stem remains comparatively undeveloped, but the leaf has unlimited apical growth, and the long midrib twines around supports like the stem of the hop, bearing pinnae at intervals. The leaves are borne on the stem in one dorsal row. The sporangia are in a double row on the back of the fertile pinnae, and each is surrounded by a cup-like indusium.

**Lyonia** Nutt. Ericaceae (II. 4). 16 sp. E. As., N. Am., 1 circumpolar. Like *Andromeda*, into which some sp. are sometimes placed.

**Lyperia** Benth. Scrophulariaceae (II. 7). 33 sp. S. Afr. United to *Chaenostoma* in *Nat. Pfl.*

**Lysimachia** (Tourn.) Linn. Primulaceae (III). 60 sp. temp. and sub-trop., esp. N. Hemisph.; 4 sp. in Brit. *L. vulgaris* L., yellow loosestrife, is said by Müller (*Fert. of Flrs.*) to occur in two forms, one in sunny places with large flrs. suited to crossing, and one in shady spots with small self-fertilised flrs. *L. nemorum* L., yellow pimpernel is common, and *L. Nummularia* L., moneywort, is frequent, though it is said never to set seed in Brit.

**Lysipomia** H. B. et K. Campanulaceae (III). 7 sp. Andes.

**Lythraceae**. Dicotyledons (Archichl. Myrtiflorae). 21 gen. with 360 sp., in all zones but the frigid. Herbs, shrubs, or trees; leaves usually opp., entire, simple, with very small stipules. Flrs. in racemes, panicles, or dichasial cymes, ♂, regular or zygomorphic, usually 4- or

6 merous. The axis ('calyx-tube') is hollow, generally tubular. The sepals are valvate, and frequently possess an epicalyx, formed, as in *Potentilla*, of combined stipules. Petals crumpled in bud, sometimes absent. Sta inserted (often very low down) on calyx tube, typically twice as many as sepals, but sometimes fewer or  $\infty$ . Ovary superior, with simple style and usually capitate stigma, it is 2—6-loc, at the base at least, rarely 1 loc with parietal placenta. Ovules usually  $\infty$ , anatropous, ascending. The flrs of *Lythrum* (q.v) and others are heterostyled. Dry fruit, usually capsular. No endosperm. *Chief genera* *Peplis*, *Lythrum*, *Cuphea*, *Lagerstroemia*. Benth.-Hooker include *Oliniaceae*, and place it in *Myrtales*, by Warming it is placed in *Myrtiflorae*.

**Lythrum** Linn. *Lythraceae* 23 sp temp, in damp places, 2 in Brit., *L. Salicaria* L. (purple loosestrife) and another. The 6-merous flrs. are solitary or in small axillary dichasia like those of *Labiatae*. Each has 12 sta in two whs of different length, and the style again is of different length to any of the sta. Three forms of flr. occur, each on a separate plant, they are distinguished as long- mid- and short-styled flrs, according to the length of the styles. The diagram illustrates the arrangement of parts (S = stigma, A = anthers, B = base of flr), as seen in side view of the flr. Darwin (*Forms of Flrs*) was the first to show the meaning of this trimorphism. It is evident that an insect visiting the flrs will tend on the whole to transfer pollen from  $A_3$  to  $S_3$ ,  $A_2$  to  $S_2$ ,  $A_1$  to  $S_1$ , rather than from sta of one length to style of another, for the insect will always enter these zygomorphic flrs in the same way and to the same depth. The sta and style project so far that an insect can alight directly upon them. Darwin showed by a long series of experiments that the best results are obtained by pollinating  $S_3$  from  $A_3$ , or  $S_1$  from  $A_1$ , &c, i.e. by crossing two plants. The number of seeds thus obtained is much greater and their fertility higher than if  $S_2$  or  $S_1$  be fertilised from  $A_3$ , or any other such union be made. Fertilisation of a stigma by sta. of corresponding length Darwin terms *legitimate*, by sta. of a different length *illegitimate* fertilisation. The offspring of illegitimate fertilisation are few in number and have the sterility and other sexual characters of hybrids.

A curious point, as yet entirely unexplained, is that here, as in nearly all other heterostyled plants, the longer the sta the larger the pollen grains, and the longer the style the larger are the papillae of the stigma.

The whole subject of heterostylism is still much in the dark. We know nothing beyond the facts, and the cause, even the advantage, of the phenomenon remains obscure. We can only class it as one of

the general methods favouring cross-fertilisation. [See Darwin, *loc. cit.*, Loew, *Einführung in die Blütenbiologie*, and p. 88.]

**Maba** Forst. Ebenaceae. 63 sp. trop. and subtrop. The wood of some sp. is used as a substitute for ebony. Fruit of some sp. edible.

**Macadamia** F. Muell. Proteaceae (II). 3 sp. Austr. (nut-tree). The seeds are edible, tasting like filberts.

**Macaranga** Thou. Euphorbiaceae (A. II. 2). 90 sp. Old World trop. *M. caladifolia* Becc. has hollow peduncles inhabited by ants (p. 117).

**Macfadyena** A. DC. Bignoniaceae (I). 8 sp. S. Am.

**Machaerium** Pers. Leguminosae (III. 8). 60 sp. trop. Am. Resembles Dalbergia. Many are lianes, climbing by sensitive lateral shoots, and provided with recurved stipular thorns (see p. 177).

**Mackaya** Harv. = *Asystasia* Blume.

**Macleania** Hook. Ericaceae (III. 8). 12 sp. W. trop. Am.

**Macleya** Rchb. = *Bocconia* Linn.

**Maclura** Nutt. Moraceae (I). 1 sp. South-west U.S., *M. aurantiaca* Nutt., the bow-wood or Osage orange. The tree bears thorns (branches). Flrs. dioecious, the ♂ in pseudo-racemes, the ♀ in pseudohheads. The individual flrs. are like those of *Morus*. After fertilisation each ♀ flr. produces an achene enclosed in the fleshy perianth, and at the same time the common receptacle swells up into a fleshy mass, so that a large yellow multiple fruit is formed. The wood is used for bows, carriage-poles, &c. The leaves are used for feeding silkworms. [For *M. tinctoria* D. Don, &c., see *Chlorophora*.]

**Macroplectrum** Pfitz. = *Angraecum* Bory.

**Macrozamia** Miq. Cycadaceae. 14 sp. Austr.

**Madia** Molina. Compositae (V). 12 sp. W. Am.

**Maerua** Forsk. Capparidaceae (III). 20 sp. trop. Afr., As. The fruit is a berry, constricted between the seeds like a lomentum.

**Maesa** Forsk. Myrsinaceae (III). 35 sp. trop., except Am.

**Magnolia** Linn. Magnoliaceae (I). 21 sp. As., N. Am. (esp. trop.).

Trees with sheathing stipules covering the bud, and terminal flrs. The perianth is petaloid, except sometimes the outermost leaves, and is in whorls. The sta. and cpls. are  $\infty$ , on a lengthened torus. The flr. is protogynous, and in the sp. usually grown in England is said to act as a 'trap flower' (p. 92). The petals! at first, while the stigmas are ripe, stand vertically, leaving only a small opening into the flr. Insects resort to it (? beetles) for honey and shelter, and are unable to escape until the second stage supervenes, when, the anthers having shed their pollen, the flr. opens widely. The fruit is an aggregate of follicles; each dehisces by its *dorsal* suture, and the seed dangles out of it on a long thread formed by the unravelling of the spiral vessels of the funicle. The outer integument of the ovule becomes fleshy as it ripens, and the seeds may thus be distributed by birds. Several sp. are cultivated for their magnificent flrs.

**Magnoliaceae**. Dicotyledons (Archichl. Ranales). 9 gen. with 70 sp.

of trop. and sub-trop. trees and shrubs (some climbing). They have alt. leaves, which in the *Magnoliceae* have big stipules, united to form a thimble-like hood, covering in the bud all the younger leaves. As each leaf expands it throws off the hood of the next older leaf. The flrs. are terminal (in most sp.) or axillary, usually solitary, ♂ or unisexual. In the *Magnoliceae* the perianth is cyclic, in the rest of the order it is spiral, as are the sta. and cpls. throughout. The perianth is usually petaloid. Sta.  $\infty$ , hypogynous. Cpls. usually  $\infty$ , on a long torus. Fruit a follicle, berry, or samara. Seed albuminous, the endosperm not ruminate. The timber of most *M.* is good. Illicium, &c., furnish economic products. *Magnolia* and *Liriodendron* are cultivated for their flrs. &c.

*Classification and chief genera* (after Prantl).

A. Leaves with stipular hoods:

1. *Magnoliceae*: *Magnolia*, *Liriodendron*.

B. Leaves without hoods:

2. *Schizandreae* (climbing): *Kadsura*, *Schizandra*.

3. *Illicieae* (erect): *Illicium*, *Drimys*.

**Mahernia** Linn. Sterculiaceae. 30 sp. S. Afr. Included in *Hermannia* in *Nat. Pfl.*

**Mahonia** Nutt. = *Berberis* Linn.

**Maianthemum** Weber. Liliaceae (VII). 1 sp. N. temp. (incl. Brit.), *M. bifolium* DC. (*M. convallaria* Weber). Flr. 2-merous, protogynous.

**Maleta** Aubl. Melastomaceae (I). 8 sp. trop. Am. Some have bladdery outgrowths of the leaves inhabited by ants (cf. *Duroia*).

**Malachium** Fries = *Stellaria* Linn.

**Malachra** Linn. Malvaceae (III). 5 sp. trop. Am.

**Malacocarpus** Salm-Dyck = *Echinocactus* Link et Otto.

**Malacothrix** DC. Compositae (XIII). 15 sp. Calif.

**Malaxis** Soland. ex Sw. Orchidaceae (8). 1 sp. N. temp. (incl. Brit.), *M. paludosa* Sw. The flr. is twisted through 360°, so that the labellum is again uppermost. Perhaps some ancestral form exhibited the usual orchid pattern. See Darwin's *Orchids*, p. 130.

**Malcomia** R. Br. (*Malcolmia* Spreng). Cruciferae (IV. 18). 30 sp. Medit.

**Malesherbia** Ruiz et Pav. Malesherbiaceae. 18 sp. west S. Am.

**Malesherbiaceae**. Dicotyledons (Archichl. Parietales). 1 gen., *Malesherbia*. United to *Passifloraceae* by Benth.-Hooker; it differs from *P.* in having no aril and in having the styles more deeply inserted and widely separated. It differs from *Turneraceae* in having no aril, in the aestivation of the corolla, and in the persistent receptacle.

**Mallotus** Lour. Euphorbiaceae (A. II. 2). 80 sp. Old World trop.

**Malope** Linn. Malvaceae (I). 3 sp. Medit. The 3 leaves of the epicalyx are very large. Cpls.  $\infty$ , in vertical rows (see order).

**Malpighia** Plum. ex Linn. Malpighiaceae (II). 20 sp. trop. Am. Not climbers. Some sp. have stinging hairs; some have cleistogamic flrs.

**Malpighiaceae.** Dicotyledons (Archichl. Geraniales). 55 gen. with 650 sp., trop., esp. S. Am. Shrubs or small trees, usually climbing, forming a marked feature among the trop. lianes. The stem-anatomy is peculiar (p. 178). Leaves usually opp., entire, stip., frequently gland-dotted. The plants are usually covered with peculiar branched unicellular hairs. Infl. racemose. Flr.  $\frac{5}{5}$ , obliquely zygomorphic. K (5), imbricate, often with large glands at the base of (outside) the sepals; C 5, petals usually clawed, imbricate; A 5+5, obdiplostemonous, often fewer, joined in a ring at the base; anthers opening introrsely by longitudinal splits;  $\bar{G}$  (3), obliquely placed in the flr., 3-loc. with axile placentae. One ovule in each loc., pendulous, semi-anatropous, with ventral raphe. Fruit typically a schizocarp breaking into 3 mericarps, but frequently one or more of the loc. abort. The mericarps are often winged, in some cases, e.g. *Banisteria*, like those of *Acer*. Seed exalbuminous.

*Classification and chief genera* (after Niedenzu):

I. *Pyramidotorae* (torus pyramidal; mericarps usually winged):  
Tetrapteris, *Banisteria*, *Acridocarpus*.

II. *Planitorae* (torus flat or concave; mericarps not winged):  
*Malpighia*, *Bunchosia*, *Byrsonima*.

[Placed in Geraniales by Benth.-Hooker, in Aesculinae by Warming.]

**Malus** Tourn. ex Linn. = *Pyrus* Tourn.

**Malva** (Tourn.) Linn. (excl. *Callirhoe* Nutt.). Malvaceae (11). 25 sp. N. temp.; 3 in Brit. Flr. of the ordinary type of the order, with  $\infty$  cpls. Two Brit. sp. *M. sylvestris* L. and *M. rotundifolia* L. (large and small mallow) afford an interesting contrast in floral mechanism, &c. Honey is secreted in little pockets in the receptacle, covered with hairs which exclude rain and very short-tongued insects. The large mallow is very protandrous; the sta. stand up at first in the middle of the flr., and afterwards bend outwards and downwards whilst the styles lengthen and occupy the original positions of the sta. The small mallow has much smaller flrs. which are much less visited by insects (see lists of visitors in Müller's *Fert. of Flrs.*); they go through stages similar to those described above, but at the end of the female stage the styles bend downwards, twist in among the anthers and pollinate themselves (see p. 82).

The leaves in autumn may usually be seen covered with brown spots caused by the fungus *Puccinia malvacearum* (cf. Berberis).

**Malvaceae.** Dicotyledons (Archichl. Malvales). About 35 gen. with 700 sp. trop. and temp. Herbs, shrubs, or trees, with stip. leaves. Flrs. solitary or in compound cymose infls. made up of cincinni,  $\frac{5}{5}$ , regular, usually 5-merous. Very often an epicalyx is present; it is probably an aggregation of bracteoles, but has been regarded as stipular like that of some Rosaceae (q.v.). K 5 or (5), valvate; C 5, convolute, the petals usually asymmetrical; A usually  $\infty$ , owing to

branching of the inner whorl of sta. (the outer is usually absent), all united below into a tube which is joined to the petals and at first sight makes the corolla appear gamopetalous; the anthers are monothealous (*i.e.* each = half an anther), the pollen grains spiny.  $\underline{G}$  ( $1-\infty$ ) frequently (5), multi-loc., with axile placentae. In sub-order I a division of the cpls. by horizontal transverse walls occurs, producing vertical rows of one-ovuled portions. Ovules  $1-\infty$  in each cpl., anatropous, usually ascending, sometimes pendulous. Malvaceae has a berry, the rest of the order dry fruits, either capsules or schizocarps. Embryo usually curved, surrounded by endosperm. The fls. are generally protandrous (see *Malva* and *Goethea*). *Gossypium* (cotton), *Hibiscus*, and others are of economic value. Many are garden favourites.

*Classification and chief genera* (after Schumann): Benthams and Hooker unite Bombacaceae to Malvaceae and place them in cohort Malvales. Warming places M. in Columniferae.

A. Cpls. in vertical rows.

I. *Malopeae*: *Malope*, *Kitaibelia*.

B. Cpls. in one plane.

II. *Malveae* (schizocarp; styles as many as cpls.): *Abutilon*, *Lavatera*, *Althaea*, *Malva*, *Anoda*.

III. *Urenaee* (schizocarp; styles twice as many as cpls.): *Urena*, *Goethea*, *Pavonia*.

IV. *Hibisceae* (capsule): *Hibiscus*, *Gossypium*.

**Malvales.** The 18th cohort (Engler) of Archichlamydeae (p. 138).

The 6th cohort (Benth.-Hooker) of Polypetalae (p. 142).

**Malvastrum** A. Gray. Malvaceae (II). 70 sp. Am. and S. Afr.

**Malvaviscus** Dill. ex Adans. Malvaceae (III). 10 sp. trop. Am.

**Mammea** Linn. Guttiferae (IV). 1 sp. W. Ind., *M. americana* L., largely cultivated for its edible fruit, the Mammee or St. Domingo apricot. The fls. are used in preparing a liqueur (eau de Créole).

**Mammillaria** Haw. (incl. *Anhalonium* Lem.). Cactaceae (I. 2). 360 sp. trop. Am. Mostly small plants of very condensed form, often almost spherical in outline, with well-marked mammillae (see order). There is a division of the growing point into two in the course of formation of the mammilla, and the part at the base of the mammilla (*i.e.* in the axil) gives rise to the flr. The gynœceum elongates after fertilisation so that the tip of the long red berry is raised clear of the thorns. In some sp. vegetative reproduction and dispersal occurs by the mammillae breaking off and blowing about or adhering to animals. The fruit is edible.

**Mandevilla** Lindl. Apocynaceae (II. 4). 30 sp. trop. and sub-trop. Am.

**Mandragora** (Tourn.) Linn. Solanaceae (II). 3 sp. Medit., Himal. (mandrake). For the superstitions connected with this plant, see *Treas. of Bot.*

**Manettia** Mutis. Rubiaceae (I. 4). 24 sp. trop. Am.

**Mangifera** Linn. Anacardiaceae (I). 27 sp. Indo-mal. *M. indica* L.

is the mango, everywhere cultivated in the tropics for its fruit, which is a large drupe derived from the 1 cpl. of the flr.

**Manihot** Tourn. ex Adans. Euphorbiaceae (A 11. 4). 80 sp. S. Am. Shrubs and herbs with monœcious flrs. *M. Glaziovii* Müll.-Arg. and other sp. show bud-protection well. The petiole of the young leaf curves upwards and inwards, so that the leaf is brought above the bud, thus protecting it from radiation &c. *M. utilisissima* Pohl is the bitter, *M. Aipi* Pohl (*M. palmata* Mull.-Arg.) the sweet cassava or mandioc; both are extensively cultivated in the tropics for their large tuberous roots, which contain much starch, &c., and form a valuable food-stuff. The bitter cassava is the one usually cultivated: its poisonous juice is squeezed out, and finally dissipated in the drying. The ground roots form mandioc or cassava meal, sometimes called Brazilian arrowroot. By a special mode of preparation, tapioca is prepared from the root. The poisonous juice, evaporated to a syrup and thus rendered harmless, forms an antiseptic, known as cassareep, used in preserving meat &c. *M. Glaziovii* is the Ceara rubber; indian-rubber is obtained by tapping the stem of the tree in the usual way.

**Manna** D. Don = Alhagi Tourn.

**Mantisia** Sims. Zingiberaceae. 2 sp. E. Ind. *M. saltatoria* Sims (dancing girls) is often grown in hot-houses for its curious flrs. They are borne on separate shoots springing from the rhizome. At the base is the calyx, then 3 broad petals, a curiously shaped labellum and 2 filamentous staminodes, and beyond all the fertile sta. and style.

**Manulea** Linn. Scrophulariaceae (11. 7). 26 sp. S. Afr.

**Maoutia** Wedd. Urticaceae (3). 8 sp. trop. As. and Polynes. There is no perianth in the ♀ flr. *M. Puya* Wedd. is the source of a valuable fibre.

**Mapouria** Aubl. Rubiaceae (11. 15). 80 sp. E. Ind., S. Am. Included in Psychotria by Benth.-Hooker.

**Mappa** A. Juss. = Macaranga Thou.

**Maranta** Plum. ex Linn. Marantaceae. 15 sp. trop. Am. The staminodes  $\beta \gamma$  (see order) are present in many sp. The rhizome of *M. arundinacea* L. furnishes West Indian arrowroot, prepared by grinding and washing to free the starch.

**Marantaceae.** Monocotyledons (Scitamineae). 12 gen. with 150 sp. trop., chiefly Am. Herbaceous perennials of various habit, resembling Zingiberaceae, but at once distinguishable by the presence of a swollen pulvinus or joint at the junction of petiole and leaf-blade. Leaves 2-ranked, sheathing; one side of the leaf is larger than the other and is covered by it when the leaf is rolled up in the bud. Flrs. usually upon the leafy shoots, in pairs in the axils of the bracts, either one pair or many (cymose, drepania). The flr. is asymmetric, but in each pair the one is complementary to the other (*i.e.* like its reflection in a glass). Flr. ♀, pentacyclic, 3-merous. P 3 + 3, clearly distinguished in most cases into calyx and corolla. As in the allied

orders, the andrœceum is united to the corolla. There is one fertile sta., often petaloid, and round it various petaloid structures (cf. carefully *Canna* and *Zingiberaceae*). The labellum of *Canna* is represented by a hood-shaped leaf covering the style (Kapuzenblatt). The staminode  $\alpha$  is represented by a more or less leathery or callous leaf (Schwielenblatt);  $\beta$  and  $\gamma$  are not always present, but are petaloid when they do occur. The same views as to the morphology of these structures have been proposed as in the case of *Canna* (q.v.). The inferior ovary is of (3) cpls., typically 3-loc. 3-ovuled, but commonly 2 of the loc. are abortive (as in fig.) and the third contains one ovule; ovule ana-campylo-tropous: style curved and at first enclosed in the 'Kapuzenblatt' or hood. The flr. often has an explosive mechanism. The pollen is shed upon the style, which remains held in the hood. Insects enter upon the staminode  $\alpha$ , and in sucking honey (secreted by glands in the septa of the ovary) set free the style, which descends with a sudden shock, touching the insect's back and at the same time showering the pollen upon it (cf. *Genista*). The fruit is usually a loculicidal capsule. Embryo curved, in perisperm. Seed often arillate. *Maranta* and others furnish arrowroot, &c. *Chief genera*: *Calathea*, *Maranta*, *Thalia*. [Benth.-Hooker unite *M.* to *Cannaceae*, *Musaceae*, and *Zingiberaceae* to form the order *Scitamineae*, placed in *Epigynae*. Warming places it in coh. *Scitamineae*.]



Floral diagram of *Maranta bicolor* (modified from Eichler).  $\alpha\beta\gamma$ , staminodes; L., labellum (Kapuzenblatt).

**Marattia** Sm. Marattiaceae (11). 7 sp. trop. The synangium is oval and the compartments open by slits into a central space.

**Marattiaceae.** Filicineae Eusporangiatae. 4 gen. with 25 sp., trop. They are large ferns, with a stout stem rarely more than a couple of feet long, not branched (exc. *Danaea*), and large pinnate leaves (palmate in *Kaulfussia*). At the base of the leaf, which shows circinate veneration, occur a pair of stipules, which aid in bud-protection. The roots arise at the growing point, one or more to each leaf; they burrow obliquely outwards emerging some distance from the apex.

The sporangia are very numerous, and occur upon the veins on the lower side of ordinary foliage leaves. The sorus stands on a swollen placenta; in *Angiopteris* the component sporangia are free from one another, in the other genera they combine to form a *synangium*, with as many chambers as there are sporangia. The mode of opening varies (see classification, below). The spores are all of one kind (except that they vary in shape), and give rise to monœcious prothalli, resembling those of the ordinary ferns. These are large and may live for some years.



*Classification and genera:*

- I. *Angiopterideae* (sporangia free): Angiopteris.
  - II. *Maratticeae* (synangia oval): *Marattia* (leaf pinnate); *Kaulfussia* (leaf palmate with curious chambers on lower side).
  - III. *Danaeae* (synangia long, opening by terminal pore): *Danaea*.
- Marcgravia** Plum. ex Linn. Marcgraviaceae. 16 sp. trop. Am. They are climbing epiphytic shrubs, with two kinds of shoots—vegetative, with two-ranked sessile leaves and clasping roots, and flowering, with stalked leaves, spirally arranged, and ending in a cymose umbel of flrs. The central flrs. are abortive and their bracts are transformed into curious pocket-like coloured nectaries with stalks. The fertile flrs. stand upside down, the infl. being pendulous, and humming-birds rub against them with their backs, while drinking honey from the nectaries.
- Marcgraviaceae.** Dicotyledons (Archichl. Parietales). 5 gen. with 40 sp. trop. Am. Trees or shrubs, often epiphytic, usually with pendulous infls. whose bracts are brightly coloured and transformed into nectaries. Flrs.  $\frac{5}{4}$ . K 4—5; C (4—5), dropping off as a cap; A  $3-\infty$ , free or united to one another and to the corolla. Ovary superior, originally 1-loc. with 2 parietal placentae; ovules  $\infty$ , anatropous; style simple. Capsule. Endosperm thin. *Chief genera:* *Marcgravia*, *Norantea*. Benth.-Hooker unite *M.* to Theaceae (Ternstroemiaceae); Warming places it in Cistiflorae.
- Margyricarpus** Ruiz et Pav. Rosaceae (III. 9). 1 sp. Andes.
- Marica** Ker-Gawl. Iridaceae (II). 9 sp. trop. Am., Afr.
- Mariscus** Gaertn. = *Cyperus* Linn.
- Marlea** Roxb. = *Stylidium* Lour.
- Marlierea** Cambess. Myrtaceae (I). 50 sp. Brazil. The fruits of *M. tomentosa* Cambess. (Guapuronga) and *M. edulis* Ndz. (*M. glomerata* Berg) are eaten.
- Marrubium** Tourn. ex Linn. Labiatae (VI. 1). 30 sp. Eur., N. Afr., temp. As. *M. vulgare* L., white horehound, in Brit. (rare), formerly official.
- Marsdenia** R. Br. Asclepiadaceae (II. 4). 70 sp. trop. and sub-trop.
- Marsilia** Linn. Marsiliaceae. 30 sp. trop. and temp. The stem is a rhizome bearing leaves at the nodes, and roots on the lower side. The leaves are petiolate with four lobes, resembling those of '4-leaved clover.' They 'sleep' at night like those of *Oxalis*. In some sp. they are floating, on delicate petioles. Others grow in shallow water, the leaves standing erect. Some sp., e.g. *M. vestita* Hook. et Grev., vegetate during the wet season, and pass the dry in the form of sporocarps.
- The sporocarp is a bean-like structure, attached to the petiole of the leaf by a stalk. It contains a number of sori, each forming a chamber reaching from the ventral to the dorsal edge of the sporocarp. In each sorus on the outer side is a placenta in the form of a ridge bearing micro-sporangia on its sides and mega-sporangia on the top.

The latter contain one spore each. The sporocarp is very hard and may remain in water a long time without showing any effect. Ultimately however, or at once if the hard shell be injured, a swelling of the mucilaginous interior tissue bursts it. "As more water is absorbed, this gelatinous inner tissue continues to expand, and forms a long worm-shaped body to which are attached a number of sori, each surrounded by a sac-shaped indusium in which the sporangia are closely packed" (Campbell). The spores are finally set free by the dissolution both of indusium and sporangium wall. The prothalli are similar to those of Salviniaceae.

The sporocarps of *M. salvatrix* Hans. (*M. Drummondii* A. Br.) are eaten by the natives of Austr., under the name nardoo.

**Marsiliaceae.** Filicineae Leptosporangiateae (Heterosporous). A family composed of 2 genera (Marsilia, Pilularia) with 40 sp. trop. and temp. The mature plant is aquatic or amphibious and has a thin creeping stem, growing by an apical cell, and bearing leaves at distinct nodes. The leaves are circinate in veneration like those of the ordinary ferns, but vary much in type (see genera). Roots are formed from the lower side of the stem.

The sporangia are contained in sporocarps, which are complex structures not homologous with those of the Salviniaceae. Each is the equivalent of a leaf-segment and encloses several sori, the latter composed both of micro- and mega-sporangia. Each spore is furnished with an epispore of hardened frothy mucilage. The spores pass the winter (or dry season) inside the sporangia. The subsequent stages in the life history resemble those of Salviniaceae. See genera for details.

**Martynia** Houst. ex Linn. (incl. *Prohoscidea* Schmid.). Martyniaceae. 6 sp. trop. and sub-trop. Am. Flrs. with sensitive stigmas like those of *Mimulus*. The fruit has 2 long curved horns, admirably adapted for animal-distribution; for either it is carried off bodily, or else the hooks, like those of the burr of *Arctium*, catching passing animals cause a jerk which scatters the seeds out of the capsule.

**Martyniaceae.** Dicotyledons (Sympet. Tubiflorae). 2 gen. with 10 sp. trop. and sub-trop. Am., in dry or coast regions (p. 187). Herbs, often with tuberous roots, with opp. or alt. leaves, and terminal racemes of  $\frac{3}{5}$ , 5-merous, zygomorphic flrs. K ( $\frac{5}{5}$ ); C ( $\frac{5}{5}$ ); A 4 with a staminode, epipetalous, didynamous;  $\overline{G}$  (2), 1-loc. with parietal placentae, and  $\infty$  or few anatropous ovules. Capsule loculicidal, the outer pericarp soft and falling off, the inner woody; it is rendered more or less 4-loc. by the union of the T-shaped placentae together and to the endocarp. The tissue at the top of the midrib of each cpl. also becomes woody and forms a projecting spur, usually hooked at the end or curved, and serving for animal distribution. Seeds with little endosperm. *Genera*: *Martynia*, *Craniolaria*. United to *Pedaliaceae* by Benth.-Hooker and Warming.

**Mascagnia** Bert. = *Hiraea* Jacq.

**Masdevallia** Ruiz et Pav. Orchidaceae (12). 100 sp. trop. Am., Mexico. Petals small; sepals drawn out into long processes (Darwin, *Orchids*, p. 135).

**Massonia** Thunb. ex Linn. f. Liliaceae (v). 20 sp. S. Afr.

**Matayba** Aubl. = *Ratonia* DC.

**Mathiola** R. Br. = *Matthiola* R. Br.

**Matricaria** (Tourn.) Linn. Compositae (vii). 50 sp. S. Afr., Medit., Orient; 2 in Brit. (wild chamomile or feverfew), incl. *M. Chamomilla* L. (officinal).

**Matthiola** R. Br. Cruciferae (iv. 19). 50 sp. Medit., Eur., S. Afr. 2 in Brit. (stock) on the coasts, incl. *M. incana* R. Br., the parent sp. of the garden stock (see p. 95).

**Maurandia** Orteg. Scrophulariaceae (ii. 5). 6 sp. Mexico. Leaf-climbers with sensitive petioles (p. 177), cultivated for their flrs.

**Mauritia** Linn. f. Palmae (iii. 4). 9 sp. trop. Am., W. Ind. (Moriche, see Kingsley's *At Last*). They furnish wood, leaves for thatching &c., wine, fruit, fibre, &c.

**Maxillaria** Ruiz et Pav. Orchidaceae (27). 100 sp. trop. Am. Epiphytes.

**Maximiliana** Mart. Palmae (iv. 7). 3 sp. trop. Brazil.

**Mayaca** Aubl. Mayacaceae. 7 sp. Am.

**Mayacaceae**. Monocotyledons (Farinosae). Only genus *Mayaca*. Placed in Coronarieae by Benth.-Hooker, in Enantioblastae by Warming. See *Nat. Pfl.* for details.

**Mayepea** Aubl. = *Linociera* Sw.

**Maytenus** Molina. Celastraceae. 70 sp. S. Am. *M. Boaria* Molina is used as a fodder-plant, the tree being cut down.

**Mazus** Lour. Scrophulariaceae (ii. 8). 6 sp. China to Austr.

**Meconopsis** Vig. Papaveraceae (ii). 10 sp. N. temp. *M. lambrica* Vig., the Welsh poppy, in Brit.

**Medicago** Tourn. ex Linn. Leguminosae (iii. 4). 50 sp. Eur., Medit., S. Afr.; 6 in Brit. (medick, nonsuch, burweed). The flr. has an explosive mechanism like *Genista* (q.v. and see Burkil in *Proc. Camb. Phil. Soc.* 1894). The fruit is usually twisted, often spirally coiled up into a ball or disc, and frequently provided with hooks for animal-distribution. *M. sativa* L. (lucerne or alfalfa), *M. lupulina* L., and others, are useful fodder-plants.

**Medinilla** Gaudich. Melastomaceae (i). 100 sp. W. Afr., As., Polynes.

**Megacarpaea** DC. Cruciferae (ii. 5). 5 sp. Steppe. Sta. > 6 in some sp.

**Melaleuca** Linn. Myrtaceae (2). 100 sp. Austr. *M. Leucadendron* L. reaches into Indo-mal. region, the Philippines, &c. Its leaves yield Cajeput oil. Sta. in bundles opposite the petals. Several sp. yield oil; the timber is useful.

**Melampodium** Linn. Compositae (v). 25 sp. Am.

**Melampyrum** (Tourn.) Linn. Scrophulariaceae (III. 12). 25 sp. N. Hemisph.; 4 in Brit. (cow-wheat). Semi-parasites (see order). The flr. has a loose-pollen mechanism (p. 91 and order); the 4 anthers lie close together and form a pollen-box; the filaments of the sta. are covered with sharp teeth which ensure that a bee shall insert its proboscis down the middle line of the flr.

**Melandrium** Roehl. = *Lychnis* Linn. [*M. rubrum* Garcke = *L. dioica*.]

**Melanorrhoea** Wall. Anacardiaceae (I). 6 sp. Malay. *M. usitata* Wall. (Theetsee) yields a valuable black varnish, obtained by tapping the stem; the sap turns black on exposure to air.

**Melanoxylon** Schott. Leguminosae (II. 8). 1 sp. Brazil, *M. Brauna* Schott (Brauna). The timber is useful.

**Melanthium** Clayt. ex Linn. Liliaceae (I). 3 sp. N. Am.

**Melastoma** Burm. ex Linn. Melastomaceae (I). 40 sp. trop., exc. Afr., Am.

**Melastomaceae.** Dicotyledons (Archichl. Myrtiflorae). 148 gen. with 2500 sp. of trop. and sub-trop. plants, forming a very natural family, easy to recognize in most cases, even when not in flr., on account of the peculiar leaf-veining &c. The habit of the various genera differs much, as they inhabit very various soils and exist under varied conditions. Some are herbs, others trees or shrubs; some climb, usually by roots; some are epiphytes, water or marsh plants. The leaves are nearly always decussate (the stem is often 4-angled), but one leaf is generally much larger than the other (p. 38); the lesser in some cases withers away as it grows older, and drops off. The veins of the leaf, which is usually simple and entire or nearly so, diverge from the base and converge again at the apex, as in many monocotyledonous leaves, so that there is no true midrib. This peculiarity is possibly correlated with the fact that most of these plants live in rainy tropical regions, and this arrangement of the veins aids in conveying away the water from the surface of the leaf (see *Ficus religiosa* and p. 154). Many M. are myrmecophilous plants, e.g. *Tococa*, *Maieta*, &c. (q.v.).

The infl. is cymose, but exhibits great variety. The flr. is usually very characteristic and easily recognized by the curious appendages of the anther-. The receptacle ('calyx-tube') is tubular or bell-shaped, commonly more or less united with the ovary, and very often brightly coloured. K 4 or 5; C 4 or 5, perigynous. The perianth is usually regular, but irregularity often occurs in the androeceum. Sta. usually twice as many as petals, standing (when mature) in one whorl, bent down in bud so that the anthers come between the ovary and the receptacle. The anther-loculi open by a common apical pore. The connective is developed in various ways and usually provided with curious appendages, frequently of sickle-like form, giving a characteristic aspect to the flr. Ovary superior or inferior, usually 4—5-loc.,

with a simple style and stigma; ovules  $\infty$ , anatropous, on axile placentae. Fruit a berry or loculicidal capsule. Seed exalbuminous; one cotyledon larger than the other. The *M.* are of little economic importance; a few yield colouring matters.

*Classification and chief genera* (after Krasser):

A. Fruit many-seeded. Embryo very small.

I. *MELASTOMATOIDEAE* (ovules on slightly projecting placentae in inner angle of loc.): Tibouchina, Centradenia, Melastoma, Monochaetum, Medinilla, Leandra, Miconia, Tococa, Maieta.

II. *ASTRONIOIDEAE* (ovules on a placenta at base or on wall of loc.): Kibessia.

B. Fruit 1—5-seeded. Embryo large.

III. *MEMECYLOIDEAE*: Memecylon.

[Placed in Myrtales by Benth.-Hooker, in *Myrtiflorae* by Warming.]

**Melia** Linn. (incl. *Azadirachta* A. Juss.). Meliaceae. 12 sp. trop., except Am. Some are useful for their timber. *M. Azedarach* L., the Margosa, is cultivated for its flrs. The bark of *M. Azadirachta* L. (*A. indica* A. Juss.) is astringent and yields the medicinal Nim or Margosa oil.

**Meliaceae.** Dicotyledons (Archichl. Geraniales). 40 gen. with 600 sp. trop. and sub-trop. Most are trees and shrubs, with alt. exstip. pinnate leaves, and cymose panicles of  $\delta$  regular flrs. K (4—5) or 4—5; C 4—5; A 8—10 usually united below into a tube, or sometimes united all their length, in which case the anthers are sessile on the tube; disc present or not;  $\bar{G}$  2—5-loc. or rarely 1-loc. or more than 5-loc.; style present or not; ovules in each loc. 1, 2, or more, usually pendulous and anatropous, with ventral raphe. Capsule, berry, or drupe; seeds often winged, with endosperm. Many, e.g. *Swietenia* (mahogany), *Cedrela*, &c., yield valuable timber; the seeds of several are used as sources of oils; others have edible fruit. *Chief genera*: *Cedrela*, *Pteroxylon*, *Swietenia*, *Carapa*, *Melia*, *Aglaiia*, *Trichilia*. Placed in Geraniales by Benth.-Hooker, in *Terebinthinae* by Warming. [See *Flindersia*.]

**Melanthaceae.** Dicotyledons (Archichl. Sapindales). 3 gen. with 17 sp., Afr. (trop. and S.). Trees and shrubs with alt. usually stip. leaves, and racemes of  $\delta$ , median-zygomorphic flrs., whose stalks twist through  $180^\circ$  at the time of flowering. K 5 or (5), sometimes 4 by union of two sepals; C 4 or 5; disc extra-staminal; A 5 or 4 or 10, free or united at base;  $\bar{G}$  (4—5), 4—5-loc. with one basal or many axile ovules in each loc.; ovules erect or pendulous, anatropous, with ventral or dorsal raphe according as they are erect or pendulous respectively. Capsule; seed sometimes with aril; endosperm fleshy or horny. *Chief genus*: *Melanthus*. United to Sapindaceae by Benth.-Hooker, placed in *Aesculinae* by Warming.

- Melanthus** Linn. Melianthaceae. 5 sp. S. Afr. The flrs. are very rich in honey.
- Melica** Linn. Gramineae (x). 30 sp. temp., except Austr.; 2 in Brit. (melic-grass).
- Mellilotus** Tourn. ex Hall. Leguminosae (III. 4). 20 sp. temp. and sub-trop. Old World. 3 in Brit. (mellilot). The flrs. contain much honey, and are adapted to bees.
- Meliosma** Blume. Sabiaceae. 45 sp. trop. As. and Am. [See Urban in *Ber. D. Bot. Ges.* XIII. 1895.]
- Melissa** Tourn. ex Linn. Labiatae (VI. 11). 4 sp. Eur., W. As. *M. officinalis* L. is the common balm.
- Melittis** Linn. Labiatae (VI. 4). 1 sp. Eur. (incl. Brit.), *M. Melisso-phyllum* L., the bastard-barm.
- Melocactus** (Tourn.) Link et Otto. Cactaceae (I. 1). 90 sp. (?) W. Ind., S. Am. Ribbed plants, like *Cereus*. Flrs. produced at the top of the plant.
- Melochia** Dill. ex Linn. Sterculiaceae. 60 sp. trop.
- Melodorum** Hook. f. et Thoms. Anonaceae (4). 30 sp. Old. World trop.
- Melothria** Linn. Cucurbitaceae (II). 60 sp. trop. and sub-trop.
- Memecylon** Linn. Melastomaceae (III). 100 sp. trop.
- Mendoncia** Vell. Acanthaceae (II). 24 sp. trop. Am., Madagascar.
- Menisclum** Schreb. Polypodiaceae. 10 sp. trop.
- Menispermaceae**. Dicotyledones (Archichl. Ranales). 58 gen. with 200 sp. trop. and warm temp. Mostly climbing shrubs with alt. simple leaves, in whose axils are usually serial buds (p. 34). The stem-anatomy is of interest. Flrs. in axillary racemes (except *Cissampelos*, &c.), unisexual, usually dioecious. The general formula is  $K\ 3+3$ ,  $C\ 3+3$ ,  $A\ 3+3$ ,  $\underline{G}\ 3$ , but there are many exceptions. The calyx and sta. are often more than 6, and sometimes there is only 1 cpl. Ovules 1 in each cpl., ventral, pendulous, semi-anatropous. Achene; seed albuminous. The classification of the genera is largely based on the structure of the seed. A few are or have been medicinal, on account of the bitter principle in the roots. *Chief genera*: *Menispermum*, *Cocculus*, *Cissampelos*, *Jateorhiza*, *Tinospora*, *Anamirta*. Placed in Ranales by Benth.-Hooker, in Polycarpicae by Warming.
- Menispermum** (Tourn.) Linn. Menispermaceae. 3 sp. N. temp. (moon-seed).
- Mentha** (Tourn.) Linn. Labiatae (VI. 11). 40 sp. temp. and trop. A very variable genus. 6 in Brit. (mint), of which *M. piperita* L. is the peppermint, *M. Pulegium* L. the penny-royal. From the former an oil is obtained by distillation and used in medicine &c. *M. viridis* L. is cultivated as a pot-herb for flavouring.
- Mentzella** Plum. ex Linn. (incl. *Eucnide* Zucc.) Loasaceae. 46 sp. trop. and sub-trop. Am. They have no stinging hairs. In some sp. the outer sta. are sterile.

**Menyanthes** (Tourn.) Linn. Gentianaceae (II). 1 sp. *M. trifoliata* L., the buck- or bog-bean, Eur. (incl. Brit.), As., N. Am. It is a bog plant with creeping rhizome and alt. leaves. The flrs. are dimorphic heterostyled (cf. *Primula*). The rhizome has bitter tonic properties and was much used in former times (and is to this day in the Cambridgehire fens).

**Menziesia** Sm. Ericaceae (I. 2). 7 sp. E. As., N. Am. [*M. polifolia* Juss. of some Brit. floras = *Daboecia polifolia*, and *M. caerulea* Sw. = *Bryanthus taxifolius*.]

**Mercurialis** (Tourn.) Linn. Euphorbiaceae (A. II. 2). 7 sp. Medit., Eur., E. As. 2 in Brit., *M. perennis* L. and *M. annua* L. (mercury). Dioecious anemophilous flrs. Vegetative propagation in perennial sp. by rhizomes. Corolla absent. Cpls. (2).

**Merendera** Ram. Liliaceae (I). 10 sp. Medit.

**Mertensia** Roth. Boraginaceae (IV. 4). 15 sp. N. temp. 1 in Brit., *M. maritima*, S. F. Gray (gromwell), on sea-coasts (p. 187).

**Mesembryanthemum** Dill. ex Linn. Aizoaceae (II. 3). 300 sp., almost all S. Afr. They are xerophytes of the most pronounced kind with very succulent leaves, usually closely packed together; the young leaves stand face to face at the growing apex till well grown, and thus protect the young bud. In *M. obconicum* Haw. the pairs of leaves are congenitally united into a fleshy body with a little slit in the centre. Several sp. have thorns, sometimes flr.-stalks hardened after the fall of the flr., sometimes branches, as in *M. spinosum* L. (the leafy branches appear below these in the next year, in the same axils). The flrs. are usually terminal on the stems, solitary or in dichasia or cincinni. The outer sta. (due to branching) are represented by numerous petaloid staminodes, having the appearance of a corolla. The mature ovary is 5-loc. with parietal placentae; this peculiar feature is due to an excessive growth of the peripheral tissue during the development, which gradually turns the loculi completely over (cf. *Punica*). The fruit is a capsule which opens only in moist air, contrary to the usual wont of capsules (p. 183). Some, e.g. *M. edule* L. (hottentot fig), contain an edible pulp. *M. crystallinum* L. is the ice-plant, so-called because its leaves are covered with small glistening bladder-shaped hairs.

**Mesospinidium** Rchb. f. = *Odontoglossum* H. B. et K.

**Mespilodaphne** Nees = *Ocotea* Aubl.

**Mespilus** (Tourn.) Linn. = *Pyrus* Tourn. [*M. germanica* L. = *Pyrus germanica*; *M. Oxycantha* Crantz = *Crataegus Oxycantha*.]

**Mesua** Linn. Guttiferae (IV). 3 sp. India, Java. *M. ferrea* L. (Nagas or iron-wood) yields a valuable timber; its flrs. are used in perfumery.

**Metrosideros** Banks. Myrtaceae (II. 2). 20 sp. S. Afr., Sunda Is., Austr., Polynes. Some sp. furnish useful timber.

**Metroxylon** Rottb. Palmae (III. 5). Siam to New Guinea. *M. Rumphii* Mart. and *M. laeve* Mart. are the sago palms, cultivated all over the

tropics. They are tall trees whose stems die after producing their large terminal monœcious infls. (cf. *Corypha*, &c.), but form rhizome branches below. The fruit takes 3 years to ripen. The tree is cut down when the infl. appears, and the sago is obtained from the pith by crushing and washing.

**Meum** (Tourn.) Adans. Umbelliferae (6). 1 sp. *M. athamanticum* Jacq. (meu or bald-money) in Eur. (incl. Brit., where it is sub-alpine).

**Meyenia** Nees = *Thunbergia* Retz.

**Mibora** Adans. Gramineae (VIII). 1 sp. W. Eur. (incl. Brit.)

**Michauxia** L'Hérit. Campanulaceae (1). 6 sp. Orient. Flr. 7—10-merous throughout.

**Michelia** Linn. Magnoliaceae (1). 13 sp. trop. As., China. There is a gynophore between sta. and cpls. *M. Champaca* L. is cultivated for its perfumed flrs. Several sp. yield useful timber.

**Miconia** Ruiz et Pav. (*Tamonea* Aubl.). Melastomaceae (1). 550 sp. trop. Am.

**Micrembryae** (Benth.-Hooker). The 4th series of Incompletae (p. 144).

**Microcachrys** Hook. f. Coniferae (Taxac. 3; see C. for genus characters). 1 sp. Tasmania. Dioecious. Fruit-scales fleshy but not united. Seed arillate.

**Microcala** Hoffm. et Link. Gentianaceae (1. 2). 2 sp., 1 Am., the other Medit. and W. Eur. (incl. south-west England and Ireland).

**Microglossa** DC. Compositae (III). 9 sp. trop. As. and Afr. The leaves of *M. volubilis* DC. are used as a vegetable and in salad.

**Microlepis** Miq. Melastomaceae (1). 4 sp. S. Brazil.

**Microlicia**. Melastomaceae (1). 100 sp. trop. Am.

**Micromeria** Benth. Labiatae (VI. 11). 60 sp. Medit., trop. Afr., Eur., W. As., Am. *M. Douglasii* Benth. (Calif. &c.) is the Yerba buena (medicinal).

**Microseris** D. Don. Compositae (XIII). 32 sp. N. Am., S. Am., Austr., N. Z.

**Microspermae**. The 10th cohort (Engler) of Monocotyledons (p. 135). The 1st series (Benth.-Hooker) of Monocotyledons (p. 145).

**Microstylis** Nutt. Orchidaceae (8). 70 sp. As., Am. Flr. twisted through 360° (cf. *Malaxis*).

**Mikania** Willd. Compositae (II). 150 sp. trop., all but one (*M. scandens* Willd.) confined to Am. Twining herbs or shrubs, with opp. leaves.

**Millum** Linn. Gramineae (VIII). 6 sp. N. Temp. *M. effusum* L. (millet-grass) in Brit. The leaf-blade is turned over on itself (cf. *Alstroemeria*).

**Millusa** Leschen. Anonaceae (1). 24 sp. trop. As.

**Millettia** Wight et Arn. Leguminosae (III. 6). 50 sp. trop. and sub-trop. Old World.

**Millingtonia** Linn. f. Bignoniaceae (1). 1 sp. Further India.



- Miltonia** Lindl. Orchidaceae (28). 17 sp. trop. Am. Epiphytes.
- Mimosa** Linn. Leguminosae (1. 3). 300 sp. trop. and sub-trop. Am., a few in Afr. and As. *M. pudica* L., the sensitive plant, is now a common weed in many trop. lands and is universally cultivated in hot houses. The genus consists mainly of herbs and undershrubs, frequently with stipular thorns. *M. pudica* has a bipinnate leaf with four secondary petioles. It is exceedingly sensitive, and a touch or shake will make it move rapidly into the position which it assumes at night. The leaflets move upwards in pairs, closing against one another, the secondary petioles close up against one another and the main petiole drops through, about 60°. After a short time the movements are slowly reversed. They are effected by the aid of a *pulvinus* or swollen joint at each point of movement. Each pulvinus can be made to work independently of the rest by gentle stimulation, and the propagation of the stimulus from pulvinus to pulvinus may also be seen. [For physiology of the process see text-books.] The ribs of the fruit are frequently thorny and are usually dropped on dehiscence.
- Mimulus** Linn. Scrophulariaceae (11. 8). 60 sp. extra-trop. Am., S. and E. As., Austr., E. Afr. Several are favourite garden plants and one of these, *M. luteus* L., the yellow monkey-flower, has become naturalised in Brit. on river-banks &c. *M. moschatus* Dougl. is the common musk-plant of cottage windows. Insects entering the flr. touch first the stigma, which is sensitive to contact and closes up, so that self-pollination by the retreating insect is prevented (cf. Martynia).
- Mimusops** Linn. Sapotaceae (11). 35 sp. trop. *M. Balata* Crueg. (*M. globosa* Gaertn.; Guiana) yields a gutta-percha (Balata). *M. elata* Allem. is the Brazilian milk tree or Masseranduba. The timber is hard and durable, the fruit edible, "but strangest of all is the vegetable milk, which exudes in abundance when the bark is cut; it has about the consistence of thick cream also used for glue...as it hardens by exposure to air it becomes a tough substance resembling gutta-percha" (Wallace, *Amazon*, ch. 11.).
- Mina** Cerv. = *Ipomoea* Linn. [*M. lobata* Cerv. = *I. versicolor*.]
- Mirabilis** Riv. ex Linn. (excl. *Oxybaphus* L'Hérit.). Nyctaginaceae (1). 10 sp. trop. Am. At the base of the flr. is an involucre of 5 leaves resembling a calyx; it is really the bracts of a 3-flowered dichasial cyme, of which in most sp. only the central flr. is developed. In some sp., however, e.g. *M. coccinea* Benth. et Hook. f., the involucre encloses more than 1 flr. The flr. opens in the evening and is protogynous (in *M. Jalapa* L. and other common garden sp.), with ultimate autogamy on withering. The involucre often forms a parachute on the fruit. The tuberous roots of *M. Jalapa* L. (false jalap, four-o'clock, marvel of Peru) were formerly used as jalap.
- Mirbella** Sm. Leguminosae (III. 2). 16 sp. Austr.
- Mitchella** Linn. Rubiaceae (11. 17). 2 sp. N. Am. (*M. repens* L.) and Japan. Dimorphic heterostyled. The flrs. are in pairs with united

ovaries. Occasionally the calyx and corolla also fuse and we have a double ovary surmounted by a 10-lobed calyx and corolla (cf. *Lonicera*).

**Mitella** Tourn. ex Linn. Saxifragaceae (I). 7 sp. N. Am.; Japan. The inconspicuous greenish flrs. stand in unilateral racemes.

**Mitraria** Cav. Gesneriaceae (I). 1 sp. Chili.

**Mitrasacme** Labill. Loganiaceae. 28 sp. Austr., trop. As.

**Modecca** Lam. (*Adenia* Forsk.). Passifloraceae. 30 sp. trop. exc. Am.

**Modiola** Moench. Malvaceae (II). 1 sp. Amer., S. Afr.

**Moehringia** Linn. = *Arenaria* Rupp.

**Moenchia** Ehrh. = *Cerastium* Dill.

**Mogiphanes** Mart. Amarantaceae (4). 10 sp. trop. Am. Included in *Alternanthera* in *Nat. Pfl.*

**Mohria** Sw. Schizaeaceae. 1 sp. S. Afr., Madag. The sporangia are on the under side of ordinary leaves, and the margins are turned back over them (cf. *Pteris*).

**Molinia** Schrank. Gramineae (x). 1 sp. *M. caerulea* Moench, Eur. (incl. Brit.), As.

**Mollugo** Linn. Aizoaceae (I). 13 sp. trop., and N. Am.

**Moluccella** Linn. Labiatae (VI. 4). 2 sp. Medit.

**Momordica** (Tourn.) Linn. Cucurbitaceae (III). 25 sp. trop. [*M. Elaterium* L. = *Ecballium Elaterium*].

**Monachanthus** Lindl. = *Catesetum* Rich.

**Monanthes** Haw. Crassulaceae. 3 sp. Morocco, Canaries.

**Monarda** Linn. Labiatae (VI. 8). 6 sp. N. Am. Sta. 2. Flr. protandrous and visited by bees (and humming-birds in the red sp.). The leaves of some sp. are used medicinally in the form of tea (*Oswegotea*).

**Moneses** Salisb. = *Pyrola* Tourn. [*M. grandiflora* S. F. Gray = *P. uniflora*.]

**Monimia** Thou. Monimiaceae. 3 sp. Madag., Mascarenes.

**Monimiaceae**. Dicotyledons (Archichl. Ranales). 24 gen. with 150 sp., chiefly S. trop., and esp. in the 'oceanic' floral regions (Madag., Austr., Polynes.). Shrubs and trees, with leathery evergreen leaves, usually opp., exstip., and flrs. solitary or in cymes. The axis is hollowed so that the flr. is perigynous; the flrs. are commonly unisexual and often the two sexes differ in the hollowing of the axis. Frequently the bud opens by throwing off the outer ends of the perianth-leaves as a sort of lid. Perianth simple; sta.  $\infty$ , the anthers introrse or extrorse, opening by slits or valves; cpls. usually  $\infty$ , each with 1 usually basal erect anatropous ovule. Fruit of achenes, often more or less enclosed in or borne on a fleshy receptacle. The order forms a connecting link between Lauraceae and the other Ranales, being closely allied on one side to L., on the other to Calycanthaceae. *Chief genera*: *Hedycaria*, *Peumus*, *Tambourissa*, *Laurelia*. Placed in *Micrembyae* by Benth.-Hooker, in *Polycarpicae* by Warming.

**Monizia** Lowe = *Thapsia* Linn.

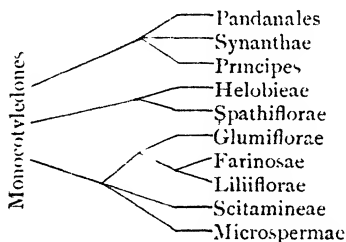
**Monnina** Ruiz et Pav. Polygalaceae. 60 sp. Mexico to Chili. One of the two cpls. is usually rudimentary. Fruit indehiscent.

**Monochaetum** Naud. Melastomaceae (1). 30 sp. W. trop. Am. Sta. dimorphous. The style, at first bent downwards, moves slowly up till horizontal.

**Monochlamydeae** (Benth.-Hooker). One of the chief divisions of Dicotyledons (p. 144).

**Monocosmia** Fenzl. Portulacaceae. 1 sp. Chili.

**Monocotyledones.** One of the two great divisions of Angiospermae. Their classification is less difficult than that of the Dicotyledons, and a comparison should be made of the ways in which it is done in the various systems (Ch. II.). Engler's system is based on the following genealogical tree (see his paper in *Abh. Preuss. Akad. Wiss.* Berlin, 1892, reviewed in *Beih. z. Bot. Cent.* 1893, p. 29, and in *Bot. Gazette* 1893, p. 191):



[See also Prantl. in 70 *Jahresb. d. Schles. Gesell. für nat. Cultur.*]

The origin of the M. is still a mystery, and their relationship to the Dicotyledons is very obscure; we do not even know if they are not derived from separate stocks of pre-Angiospermous ancestors.

**Monodora** Dun. Anonaceae (7). Fruit a berry with woody epicarp. The seeds of *M. Myristica* Dun. are sometimes used as nutmegs.

**Monotropa** Linn. (incl. *Hypopitys* Dill.). Pyrolaceae. 3 sp. N. temp. *M. Hypopitys* Walt., the yellow bird's-nest, is found in fir, birch and beech woods in Brit. as a yellowish saprophyte (p. 195) with scaly leaves and a short terminal raceme of flrs. Below the soil is found a very much branched root system, the roots being covered with a superficial mycorrhiza by whose aid absorption takes place. Buds are formed adventitiously upon the roots and lengthen into the flowering shoots. The flrs. are homogamous, without self-fertilisation. [*Monotropeae* Benth.-Hooker.]

**Monotropeae** (Benth.-Hooker). An order in cohort Ericales, including *Monotropa* and its allies; placed in Pyrolaceae by Drude in *Nat. Jfl.*

**Monsonia** Linn. Geraniaceae. 12 sp. Afr.

**Monstera** Adans. Araceae (II). 15 sp. trop. Am. Climbing shrubs with curious leaves, pinnate and full of round holes. When very young the leaf is entire; then the tissue between the veins ceases to grow rapidly, becomes dry and tears away, thus leaving holes between the ribs; at the edge the marginal part usually breaks, and thus the outermost hole gives rise to a notch in the leaf, which becomes pinnated. Beginning as a climber the plant usually ends as an epiphyte with aerial roots going down to the soil. Flrs. ♂. The fruit of *M. deliciosa* Liebm. is edible.

**Montbretia** DC. = *Tritonia* Ker-Gawl.

**Montia** Mich. ex Linn. Portulacaceae. 1 sp. *M. fontana* L. (blinks) cosmop., exhibiting many varieties. It is an annual herb, usually found in wet places, with small cymes of flrs. These are inconspicuous and homogamous, and are probably as a rule self-fertilised. In bad weather or when submerged they become cleistogamic. The stalk goes through similar movements to that of *Claytonia*, and the fruit explodes in the same way. The plant is eaten as salad.

**Moquillea** Aubl. Rosaceae (VI. 13 a). 20 sp. S. Am. Some apetalous.

**Moquinia** DC. Compositae (XII). 9 sp. S. Am. Dioecious shrubs.

**Moraceae.** Dicotyledons (Archichl. Urticales). 55 gen. with 800 sp. trop. and sub-trop., a few temp. Most are trees or shrubs with stip. leaves, and with latex. [See *Ficus*, *Cecropia*, *Maclura*, *Humulus*.] Infl. cymose, usually taking the form of (pseudo-) racemes, spikes, umbels or heads (cf. Urticaceae, and paper there cited). Flrs. unisexual. P usually 4 or (4), persistent; sta. in ♂ as many as perianth-leave- and opp. to them, bent inwards or straight in the bud, not exploding like those of Urticaceae; G in ♀ of (2) cpls. of which one is usually aborted all but the style; ovary 1-loc. superior to inferior; ovule 1, pendulous, amphitropous with micropyle facing upwards, or rarely basal and erect. Fruit an achene or drupe-like; but commonly a multiple fruit arises by union of the fruits of different flrs., often complicated by addition of the fleshy common receptacle (see *Morus*, *Ficus*, *Artocarpus*). Seed with or without endosperm; embryo usually curved. Many yield useful fruits, e.g. *Morus*, *Artocarpus*, *Ficus*, *Brosimum*, &c.; other important economic plants are *Broussonetia* (paper), *Castilloa* (rubber), *Brosimum* (milk), *Ficus* (caoutchouc, lac, timber, &c.), *Cannabis* (hemp, churrus), *Humulus* (hop) and others.

*Classification and chief genera (after Engler):*

- I. **MOROIDEAE** (sta. incurved in bud; ovule apical, ana- or amphi-tropous; leaves folded in bud; stipules small and not leaving an amplexicaul scar on falling): *Morus*, *Maclura*, *Broussonetia*, *Dorstenia*.
- II. **ARTOCARPOIDEAE** (sta. straight; ovule as in I.; leaves convolute; stipules leaving an amplexicaul scar): *Artocarpus*, *Castilloa*, *Antiaris*, *Brosimum*, *Ficus*.

III. *CONOCEPHALOIDEAE* (sta. straight; ovule at base or apex, orthotropous or slightly curved; leaves &c. as in II.): Cecropia.

IV. *CANNABOIDEAE* (sta. short and straight; ovule apical, anatropous; achene; endosperm; herbs with free stipules): Humulus, Cannabis.

[Benth.-Hooker unite M. to Urticaceae (q.v.). Warming splits off sub-order IV. as an independent order Cannabaceae, placing both it and M. in Urticiflorae.]

**Moraea** Mill. ex Linn. Iridaceae (II). 40 sp. Afr., Austr. The outer integument of the ovule becomes fleshy as it ripens to a seed.

**Moricandia** DC. Cruciferae (IV. 20). 10 sp. Medit.

**Morina** Tourn. ex Linn. Dipsacaceae. 9 sp. E. Eur., As. Thistle-like herbs, with an infl. like that of Labiatae.

**Morinda** Linn. Rubiaceae (II. 19). 40 sp. trop. Flrs. in heads; the ovaries united. Several yield dye-stuffs.

**Moringa** Burm. The only genus of Moringaceae. 3 sp. trop. Afr., As. Trees with deciduous leaves; flrs. in racemes, zygomorphic, 5-merous. \* There is a cupule-like disc bearing the sta. and perianth. Ovary on a gynophore, 1-loc. with 3 parietal placentae. Capsule pod-like. Seeds winged, exalbuminous. *M. oleifera* Lam. is largely cultivated for the sake of the oil (ben-oil) obtained from the seeds.

**Moringaceae**. Dicotyledons (Archichl. Rhoeadales). Only genus *Moringa* (q.v.). It forms a connecting link to the Rosales (Leguminosae). Benth.-Hooker place it as an anomalous order at the end of Disciflorae.

**Moringeae** (Benth.-Hooker) = Moringaceae.

**Mormodes** Lindl. Orchidaceae (17). 20 sp. trop. Am., epiphytic. The flr. presents a very complex structure; the column is bent to one side, the labellum to the other. The pollinia, with their viscid disc, are violently shot out if an insect touches the articulation of the anther to the column. For details see Darwin's *Orchids* p. 208. Cf. *Catasetum* and *Cynoches*, the other two genera of § 17.

**Morus** (Tourn.) Linn. Moraceae (I). 10 sp. N. temp. Flrs. monoecious or dioecious, the ♂ in catkins, the ♀ in pseudo-spikes, wind-pollinated. Each ovary gives an achene enclosed in the perianth whose leaves become completely united and fleshy. The whole mass of fruits thus produced on the one spike is closely packed together, giving a multiple fruit very like a black-berry (*Rubus*), but of very different morphological nature. The fruit (mulberry) is edible. The leaves of *M. alba* L. (white mulberry), *M. nigra* L. (black mulberry), and others are used for feeding silkworms.

**Mucuna** Adans. Leguminosae (III. 10). 30 sp. trop. and sub-trop. Some sp. have stinging hairs on the pods.

**Muehlenbeckia** Meissn. Polygonaceae (III. 5). 15 sp. Austr. to S. Am. *M. platyclados* Meissn. has phylloclades (p. 181), flat and green,

with transverse bands at the nodes, and green leaves which drop off early. Flrs. polygamous or dioecious.

**Muehlenbergia** Schreb. Gramineae (VIII). 60 sp. N. Am., Andes, Japan, Himal. Some are useful fodder-grasses.

**Mulgedium** Cass. = *Lactuca* Tourn.

**Multiovulatae Aquaticae** and **M. Terrestres** (Benth.-Hooker). The 2nd and 3rd series of Incompletae (p. 144).

**Muraltia** Neck. Polygalaceae. 40 sp. S. Afr.

**Murraya** Koen. ex Linn. Rutaceae (x). 4 sp. Indo-mal. The timber is useful, and the leaves are used as a condiment by the Hindoos.

**Musa** Linn. Musaceae. About 20 sp. trop., exc. Am. Large herbs with rhizomes and 'false' aerial stems (see order). The infl. springs from the rhizome and emerges at the top of the aerial 'stem.' Flrs.  $\infty$ , in the axils of leathery, often reddish-coloured bracts, the fruit-forming  $\varnothing$  flrs. at the base of the infl. The sepals and two anterior petals are joined into a tube, the posterior petal is free; there are 5 fertile sta., except in *M. Ensete* J. F. Gmel. where the posterior sta. is also fertile; the ovary is 3-loc., with  $\infty$  anatropous ovules. Fruit a longish berry. Seeds with mealy perisperm. *M. Sapientum* L., the banana, with its subsp. *M. paradisiaca* L., the plantain or pisang, is one of the most important food-plants in existence, and is everywhere cultivated in the tropics, yielding 40 times as much food per acre as even the potato. The cultivated forms are propagated entirely from the rhizomes and produce no seeds (cf. Citrus). The dried fruits are ground to form plantain-meal. The stalk of the infl. of *M. Ensete* (Abyss.) is cooked and eaten. The leaf-stalks of *M. textilis* Née (Philippines &c) furnish a useful fibre, known as Manila hemp. [For details of economic uses, &c., see *Kew Bulletin*, Aug. 1894.]

**Musaceae**. Monocotyledons (Scitamineae). 4 gen. with 60 sp. trop. They are (except *Kavenala*) gigantic herbs with rhizomes from which the leaves spring; the sheaths of the leaves are rolled round one another below, and form what looks like an aerial stem, attaining in the banana many yards in height. The leaf is large and oval, with a stout midrib, and parallel veins running from it to the edge. The edge is easily torn between the bundles, as they do not join in the same way as in a Dicotyledon; and so the wind and rain soon reduce the leaf to a very ragged condition. The flrs. are in cymes or racemes with large brightly coloured bracts or spathes; they are usually  $\varnothing$  and zygomorphic, but come much nearer to the usual type of Monocotyledonous flr. than do those of the other orders of Scitamineae (q.v.). P 3 + 3, free or united in various ways, both whorls petaloid; A 3 + 2, the posterior sta. of the inner whorl being represented by a staminode;  $\bar{G}$  (3), 3-loc., with 1— $\infty$  ovules in each loc. Fruit a berry, capsule, or schizocarp. Seed with straight embryo and mealy perisperm. The flrs. are rich in honey, and are visited by bees and birds. *Musa* is an important economic genus.

*Classification and genera:* the *M.* are closely related to the other Scitamineae to which they are joined by Benth.-Hooker, and less closely to the Liliiflorae on one hand and the Orchids on the other.

1. *Museae* (odd sepal anterior; ovules  $\infty$  in each loc.): *Ravenala*, *Strelitzia*, *Musa*. Old World (exc. 1 sp. of *Ravenala*).
2. *Heliconieae* (odd sepal posterior; ovules 1 per loc.): *Heliconia*. Confined to America.

**Muscari** Tourn. ex Mill. Liliaceae (v). 40 sp. Medit., Eur., As. *M. racemosum* Mill. (grape-hyacinth) in Brit. The upper flrs. of the raceme are neuter, serving only to give extra conspicuousness to the infl. (cf. *Centaurea Cyanus*); the lower are homogamous and becvited.

**Mussaenda** Burm. ex Linn. Rubiaceae (i. 7). 30 sp. trop. (exc. Am.). One sepal is large, leafy, and brightly coloured, and helps to make the flr. conspicuous (cf. *Euphorbia*, *Salvia*).

**Musschia** Dum. Campanulaceae (i. 1). 2 sp. Madeira (p. 158). The capsule opens by many transverse slits between the ribs.

**Mutisia** Linn. f. Compositae (xii). 50 sp. S. Am. Many are climbers (a rare habit in C.) with the ends of the leaf-midribs prolonged into tendrils. All are shrubs with large heads of flrs.

**Myanthus** Lindl. = *Catasetum* Rich.

**Myoporaceae.** Dicotyledons (Sympet. Tubiflorae). 5 gen. with 86 sp. chiefly Austr. and neighbouring Is. (1 sp. in each of the following areas:—Sandw. Is., E. As., Mauritius, Afr., W. Ind.). Most are trees or shrubs, with alt. or opp. entire exstip. leaves, which are often covered with woolly or glandular hairs, and frequently very reduced in size. Flrs. solitary, or in cymose groups, axillary,  $\frac{8}{8}$ , regular or zygomorphic. K (5), C (5), A 4, didynamous; anther loculi confluent. G (2), 2-loc. or by segmentation 3—10-loc., in the former case with 1—8, in the latter with 1, ovule in each loc. Ovule pendulous, anatropous. Drupe. Endosperm. *Chief genera:* *Pholidia*, *Myoporum*. Placed in Lamiales by Benth.-Hooker, in Labiatiflorae by Eichler (see *Bluthendiag.*).

**Myoporineae** (Benth.-Hooker) = *Myoporaceae*.

**Myoporum** Banks et Soland. Myoporaceae. 25 sp. Austr., E. As., Sandw. Is., Mauritius. *M. laetum* Forst. f. (N. Z.) yields useful timber.

**Myosotidium** Hook. Boraginaceae (iv. 1). 1 sp. Chatham Is. (p. 158).

**Myosotis** Linn. Boraginaceae (iv. 4). 30 sp. Old World temp. 8 in Brit. (scorpion-grass, forget-me-not). The corolla-mouth is nearly closed by scales, and in some sp. there is a coloured ring at the entrance forming a honey guide (see Life of Sprengel, in *Nat. Science* Apr. 1893). The colour of the corolla changes as it grows older (see order).

**Myosurus** Linn. Ranunculaceae (3). 5 sp. temp. *M. minimus* L. (mouse-tail) in Brit. The receptacle is much elongated.

**Myrcia** DC. Myrtaceae (i). 190 sp. trop. Am.

**Myrica** Linn. Myricaceae. 40 sp. Eur., As., Afr., Am., esp. sub-trop. *M. Gale* L., the sweet gale or bog-myrtle, is frequent in Brit. in mountain bogs. Its leaves have a pleasant resinous smell when rubbed or on hot days. The flrs. are in short catkins, achlamydeous. The ♂ has usually 2 bracteoles and 4 sta. (2—16); the ♀ 2—4 bracteoles and 2 syncarpous cpls. with one erect orthotropous ovule. The fruit is a nut, the exocarp secreting wax. *M. cerifera* L. (N. Am., wax-myrtle or bay-berry) and other sp. are used as sources of wax, to procure which the fruits are boiled.

**Myricaceae.** Dicotyledons (Archichl. Juglandales). Only genus *Myrica* (q.v.). Placed in Unisexuales by Benth.-Hooker, in *Juglandiflorae* by Warming.

**Myricaria** Desv. Tamaricaceae. 10 sp. Scandinavia to China.

**Myriocarpa** Benth. Urticaceae. 6 sp. trop. Am. Flrs. ∞, in catkins.

**Myriophyllum** Ponted. ex Linn. Haloragidaceae. 18 sp. cosmop.; 2 in Brit. (water milfoil). Water plants, submerged, with usually whorled much-divided leaves, borne on shoots that spring from the rhizome-like stems creeping on the ground. Land forms are occasionally produced in some sp. The infl. projects above water; and the flrs. are wind-fertilised. Hibernation by winter-buds as in *Utricularia*. [See p. 168.]

**Myristica** Linn. Myristicaceae. 80 sp. trop., esp. As. Trees with 2-ranked exstip. evergreen leaves and dioecious regular flrs. P (3), simple (cf. *Monodora*); A (3—18), extrorse; G 1, with 1 basal anatropous ovule. The fruit is a berry, but splits by both sutures, disclosing a large seed—the nutmeg—with a curious branched red aril—the mace—around it. Endosperm ruminant. The nutmeg of commerce is the seed of *M. fragrans* Houtt. (*M. moschata* Thunb.), a native of the Moluccas.

**Myristicaceae.** Dicotyledons (Archichl. Ranales). Only genus *Myristica* (q.v.). Placed in Micrembyae by Benth.-Hooker, in *Polycarpicae* by Warming. [See Warburg in *Bot. Cent.* 64, p. 204.]

**Myrmecodia** Jack. Rubiaceae (II. 15). 18 sp. Indo-mal. Epiphytes with leafy stems. The base of the stem forms a large tuber fastened to the support by adventitious roots. The tuber presents a very remarkable structure, being composed of a large mass of tissue, chiefly cork, penetrated by numerous communicating galleries and chambers, which are inhabited by ants. These galleries are formed in a peculiar way; after germination the hypocotyl swells into a small parenchymatous tuber, and in this, in an axial direction, there appears a hollow cylinder of phellogen (p. 168) which proceeds to form cork on its *inner* side and parenchyma on the outer, thus adding to the bulk of the tuber and at the same time forming in it a hollow space (for the tissue within the cylinder of cork dies and dries up) open to the surface. Near the outer surface of the tuber is a phellogen layer acting in the ordinary way, forming a bark. As the tuber grows



more phellogens appear like the first, adding more parenchyma and forming new cavities which are always in communication with the old. It has not been proved that the ants are of any service to the plant, so that it remains very doubtful whether *M.* is a truly myrmecophilous plant (see *Acacia*, *Cecropia*). The tuber seems rather to be a water-storage apparatus (p. 185). [See Goebel's *Pflanzenbiol. Sch.*, and Treub in *Ann. Buitens.* III. and VII.]

**Myrothamnaceae.** Dicotyledons (Archichl. Rosales). An order allied to Cunoniaceae, chiefly noteworthy for the dioecious achlamydeous flrs., which are apparently wind-fertilised. The only genus is *Myrothamnus*. Placed in Hamamelidaceae by Benth.-Hooker.

**Myrothamnus** Welw. Myrothamnaceae. 2 sp. S. Afr. and Madag.

**Myroxylon** Forst. (*Xylosma* Forst. f.). Flacourtiaceae. 45 sp. trop. (exc. Afr.).

**Myroxylon** Linn. f. = *Toluifera* Linn. (same specific names).

**Myrrhis** (Tourn.) Linn. Umbelliferae (5). 4 sp. Eur., W. As., N. Am. *M. odorata* Scop. in Brit. (sweet cicely or myrrh), sometimes used as a pot-herb.

**Myrsinaceae.** Dicotyledons (Sympet. Primulales). 23 gen. with 550 sp., chiefly trop. and subtrop.; a few sp. reach Cape Col., N. Z. and Florida. They are shrubs and trees with alt. leaves, often in rosettes. In some (e.g. *Theophrasta*, q.v.) the young twigs are covered with thorny scales. The leaves are usually leathery, entire, exstip., with resin-passages in their tissues. Flrs. solitary (*Deherainea*) or in racemose infis., with 2 bracteoles, ♀ or unisexual, actinomorphic, 4- or 5-merous. K (5); C (5); A 5, epipetalous and opp. to the petals; anthers introrse or extrorse; staminodes sometimes present, alt. with petals. G superior, rarely inf. or semi-inferior, 1-loc.; placenta basal or free-central with few or ∞ ovules, semi-anatropous or semi-campylotropous, sunk in placental tissue. Style and stigma simple. As the fruit ripens, most of the ovules usually abort, and there results a one- or few-seeded drupe. Embryo straight or slightly curved; endosperm fleshy or horny.

*Classification and chief genera* (after Pax): the *M.* are closely allied to Primulaceae, being distinguished chiefly by the habit and the fruit. They also approach Sapotaceae, but the latter have a chambered ovary.

A. Anther loculaments not chambered:

I. **THEOPHRASTOIDEAE** (Ovary sup. Staminodes): *Theophrasta*, *Jacquinia*, *Clavija*, *Deherainea*.

II. **MYRSINOIDEAE** (Ovary sup. No staminodes): *Embelia*, *Myrsine*, *Ardisia*.

III. **MAESOIDEAE** (Ovary inf. or semi-inf.): *Maesa*.

B. Anther loculaments transversely chambered.

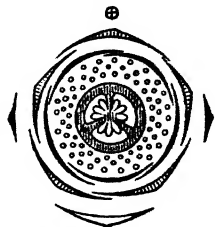
IV. **AEGICERATOIDEAE**: *Aegiceras*.

[Placed in Primulales by Benth.-Hooker, in Primulinae by Warming.]

**Myrsine** Linn. Myrsinaceae (11). 80 sp. trop. As. Afr.

**Myrsiphyllum** Willd. = *Asparagus* Tourn.

**Myrtaceae.** Dicotyledons (Archichl. Myrtiflorae). 72 gen. with about 2000 sp., trop. and sub-trop.; the chief centres of distribution are Austr. (*Leptospermoideae*) and trop. Am. (*Myrtoideae*). They are trees and shrubs, varying in size from a small creeper to the giant *Eucalyptus*, with oil-glands in leaves &c. Leaves usually opp., exstip., evergreen, entire. Flrs. generally in cymes,  $\frac{5}{8}$ , regular. The receptacle is more or less hollow and united to the ovary. In *Metrosideros* and most of its allies the union is not very complete, but in the rest of the order it is complete, and the flr. is epigynous. K (4—5) or 4—5, in some genera not opening when the flr. opens, but thrown off as a lid, usually quincuncial, with the second leaf posterior; C 4—5, the petals often nearly circular; A  $\infty$ , free, rarely definite usually bent inwards in bud; G  $\infty$ —1-loc., with 2— $\infty$  anatropous or campylotropous ovules in each loc.; style and stigma simple; placentae usually axile, rarely parietal. Fruit a berry, drupe, capsule, or nut. Seeds with no endosperm. Several M. are economically important, e.g. *Eucalyptus* (timber, kino, oil), *Eugenia* (cloves &c.), *Psidium* (guava), &c.



Floral diagram of *Myrtus communis* (after Eichler).

*Classification and chief genera:*

I. **MYRTOIDEAE** (berry, rarely drupe):

1. *Myrteae*: *Myrtus*, *Psidium*, *Pimenta*, *Eugenia*, *Syzygium*.

II. **LEPTOSPERMOIDEAE** (dry fruit):

2. *Leptospermeae* (ovary multi-loc.): *Metrosideros*, *Eucalyptus*, *Callistemon*, *Melaleuca*.

3. *Chamaelaucieae* (1-loc.; 1-seeded nut): *Darwinia*.

[Benth.-Hooker unite *Lecythidaceae* to M. and place it in *Myrtales*; Warming adds to M. both L. and *Punicaceae*, placing it in *Myrtiflorae*.]

**Myrtales** (Benth.-Hooker). The 12th cohort of *Polypetalae* (p. 143).

**Myrtiflorae.** The 22nd cohort (Engler) of *Archichlamydeae* (p. 139).

The 22nd cohort (Warming) of *Choripetalae* (p. 146).

**Myrtus** (Tourn.) Linn. (incl. *Ugni* Turcz.). *Myrtaceae*. 70 sp. trop. and subtrop. *M. communis* L., the myrtle, is a W. As. shrub, long naturalised in Eur. The Chilean sp. (§ *Ugni*) have edible fruits.

**Mystacidium** Lindl. *Orchidaceae* (31). 20 sp. Afr.

**Myzodendraceae.** Dicotyledons (Archichl. *Santalales*). Only genus *Myzodendron*. United to *Santalaceae* by Benth.-Hooker and Warming. See *Nat. Pfl.*

**Myzodendron** (Banks) Soland. *Myzodendraceae*. 7 sp. Chili, Patagonia. Semi-parasitic green shrubs (p. 194), like *Loranthaceae*.

**Naegelia** Regel (*Smithiantha* O. Ktze.). Gesneriaceae (II). 6 sp. Mexico; several are favourite stove plants. They form subterranean runners, covered with scaly leaves.

**Nagelia** Gaertn. = *Podocarpus* L'Hérit.

**Naiadaceae**. Monocotyledons (Helobieae). Only genus *Naias* (q.v.). As defined by Benth.-Hooker the order includes a number of plants here placed in different orders, viz. *Potamogetonaceae*, *Naiadaceae*, *Aponogetonaceae*, and *Juncaginaceae*.

**Najas** Linn. *Naiadaceae*. 15 sp. cosmop.; 2 in Brit. Freshwater annual plants, submerged, with slender stems and opp. usually toothed linear leaves. Flrs. diclinous; the ♂ consists of a single anther, which is terminal on the axis (see Goebel's *Entwicklungsgeschichte der Pflanzenorgane* p. 278) and 1- or 4-loc., enclosed in two sheathing perianths; the ♀ flr. consists of an ovary of one cpl., naked or surrounded by a perianth-like organ. Pollination occurs under water as in *Zostera*, but the pollen is spherical. Ovule 1, anatropous, terminal on the axis. Embryo straight; no endosperm. [See *Nat. Pfl.* and • Eichler's *Bluthendiag.*]

**Nama** Linn. *Hydrophyllaceae*. 27 sp. Am., Sandwich Is.

**Nandina** Thunb. *Berberidaceae*. 1 sp., *N. domestica* Thunb., China, Japan. The perianth (including 2 whorls of honey leaves) is in 9 whorls, showing a more petaloid structure as they near the centre.

**Napaea** Linn. *Malvaceae* (II). 1 sp. N. Am. Dioecious.

**Napoleona** Beauv. *Lecythidaceae*. 7 sp. W. trop. Afr. The flr. has a certain resemblance to that of *Passiflora*, owing to the corona of staminodes. Ovary 5—20-loc. Berry.

**Narcissus** (Tourn.) Linn. *Amaryllidaceae* (I). 40 sp., Eur., Medit., As. Several are favourites in horticulture, e.g. *N. Pseudo-narcissus* L., the daffodil, *N. poeticus* L. the poet's Narcissus, *N. Jonquilla* L., the jonquil, *N. Tazetta* L., and others. The corona is well developed, and free from the stamens (see order).

**Nardostachys** DC. *Valerianaceae*. 2 sp. Himal. *N. Jatamansi* DC., the spikenard, has very fragrant rhizomes.

**Nardus** Linn. *Gramineae* (XII). 1 sp. Eur., W. As., *N. stricta* L., the nard or mat-grass, common on moors in Brit. The infl. is markedly unilateral (an unusual feature in § XII). The grass is of no feeding value.

**Narthecium** Moehr. *Liliaceae* (I). 4 sp. N. temp.; *N. ossifragum* Huds. (bog-asphodel), abundant on wet moors in Brit. It has a sympodial rhizome and isobilateral leaves (the xerophytic structure is rendered necessary by the coldness of the soil, which checks absorption). The flr. is conspicuous, but contains no honey (p. 98).

**Narthex** Falc. = *Ferula* Tourn. *N. Asafoetida* Falc. = *F. Narthex*.

**Nassauvia** Comm. ex. Juss. *Compositae* (XII). 40 sp. Andes.

**Nasturtium** Linn. *Cruciferae* (II. II). 50 sp. cosmop.; 4 in Brit., including *N. officinale* R.Br., the water-cress. In the perennial sp.

buds arise at the base of the year's shoot, and take root while still attached to the parent shoot. The adventitious roots are said to arise exogenously (p. 22). [The N. of gardens is really *Tropaeolum*.]

**Nauclea** Linn. Rubiaceae (1. 6). 30 sp. trop. As., Polynes. Flrs. in spherical heads. In *N. lanceolata* Blume (*N. purpurea* Roxb.) there are hollow swollen portions of the stem, just below the infls., inhabited by ants (cf. *Acacia*).

**Nectandra** Roland. Lauraceae (1). 70 sp. trop. and subtrop. Am.

**Neea** Ruiz et Pav. Nyctaginaceae (2). 30 sp. trop. S. Am. The leaves of *N. theifera* Oerst. (Caparrosa) are used as tea, and also yield a black dye.

**Negundo** Moench. Aceraceae. 4 sp. N. temp. Like *Acer* (q.v.), to which it is united in *Nat. Pfl.*

**Neillia** D. Don. Rosaceae (1. 1). 3 sp. Himal., S. China.

**Nelsonia** R. Br. Acanthaceae (1). 1 sp. trop. Old World.

**Nelumbium** Juss. Nymphaeaceae (1). 2 sp., *N. luteum* Willd., Pennsylvania to Columbia, and *N. speciosum* Willd. (*N. nuciferum* Gaertn.) Japan to Caspian and N.E. Austr. The latter sp. is the sacred Lotus, no longer however found in the Nile. Sculptures of it are common in Egyptian temples, and it is still regarded as sacred in India, Tibet, China, &c. Both sp. are marsh plants; the fls., which are very large and handsome, and the big peltate slightly hairy leaves stand above the water (do not float upon it, as from analogy we should expect). The rhizome bears 'triads' of leaves; after a long internode comes a scaly-leaf on the lower side, then one on the upper side, immediately followed by a foliage-leaf with ochreate stipule, then a long internode again, and so on. This peculiar leaf-arrangement is quite unique. From the axil of the second scale-leaf springs the flr., from that of the foliage-leaf a branch. The flr. has no bracteoles. The first perianth-leaf is anterior, the second posterior, then follow 2 lateral; these 4 are sometimes regarded as a calyx. They are followed by numerous petals and sta., acyclically arranged. In the centre of the flr. stands the curious obconical gynœceum, consisting of a large number of cpls. embedded separately in the top of the swollen receptacle. Each cpl. contains 1 pendulous ovule. The receptacle becomes dry and very light, and the achenes separate from it, as the fruit ripens. It breaks off bodily from the stalk and floats about until decay sets free the fruits, which sink to the bottom of the pond. There is no endosperm or perisperm. The seeds of *N. speciosum* are used as food in Cashmere &c.

**Nelumbo** (Tourn.) Adans. = *Nelumbium* Juss.

**Nemastylis** Nutt. Iridaceae (11). 10 sp. Am.

**Nemesia** Vent. Scrophulariaceae (11. 5). 24 sp. S. Afr.

**Nemophila** Nutt. Hydrophyllaceae. 11 sp. N. Am., often cultivated. Floral mechanism &c. as in *Phacelia*.

**Nenuphar** Link = *Nuphar* Sm.

**Neotinea** Rchb. f = *Habenaria* Willd.

**Neottia** Linn. Orchidaceae (4). 3 sp. temp. Eur. and As.; *N. Nidus-avis* Rich. (bird's-nest orchis) in Brit. It is a leafless saprophyte (p. 195), the rhizome giving off a great number of roots which form a nest-like mass in the humus, and have endotropic mycorrhiza. The older roots may throw off their root-caps and develop into shoots (cf. *Anthurium*). Flr. as in *Listera* (Darwin's *Orchids*, p. 125).

**Nepenthaceae**. Dicotyledons (Archichl. Sarraceniales). Only genus *Nepenthes* (q.v.). Placed in Multiovulatae Terrestres by Benth.-Hooker, in Cistiflorae by Warming.

**Nepenthes** Linn. Nepenthaceae. 40 sp. Indo-mal., Madag. (pitcher plants). Most are herbs growing in boggy places and climbing over other plants by aid of tendrils, which form prolongations of the leaf-midribs. The end of the tendril develops as a rule into a pitcher, with a lid projecting forwards over the mouth, but not closing it except in the young state. The pitcher develops by an invagination of the upper surface of the tip of the leaf; the tip takes no part in the development, and the lid grows out below it. The edge of the pitcher is curved inwards; at the entrance there are numerous honey-glands, and for some distance below it are other glands, sunk in little pits on the inner surface of the pitcher. Insects attracted by the honey (and often by the bright colour of the pitcher) gradually work their way downwards among the glands, and presently get upon the slippery lower part and ultimately into the water in the bottom of the pitcher, where they are drowned. The plant absorbs the products of their decay, but whether it secretes a ferment that acts upon the proteids, as that of *Drosera* does, is still an open question.

Many sp. are epiphytic. In *N. ampullaria* Jack there are two kinds of leaves (cf. *Cephalotus*), some with tendrils and no pitchers; others, as stalked pitchers arranged in a radical rosette.

Flrs. dioecious, regular, in racemes or with the secondary branching cincinnal; there are no bracts. P 2 + 2; in the ♂ flr. sta. (4—16) in a column; in the ♀ flr.  $\bar{G}$  (4), 4-loc.; ovules  $\infty$ , anatropous, in many rows. Capsule leathery, loculicidal. Seeds light with long hair-like processes at the ends; embryo straight, in fleshy endosperm. Many sp. and hybrids are in cultivation. [See Goebel's *Pflanzenbiol. Sch.*, Macfarlane in *Ann. of Bot.* III. and VII., and cf. p. 195 and *Sarracenia*, *Cephalotus*.]

**Nepeta** Riv. ex Linn. (incl. *Glechoma* Linn). Labiatae (vi. 3). 100 sp. extratrop., Old World. *N. Glechoma* Benth. (ground-ivy) and *N. Cataria* L. (cat-mint) in Brit. The flrs. are markedly gynodioecious (p. 89).

**Nephellium** Linn. (excl. *Litchi* Sonner.). Sapindaceae (i). 22 sp. Indo-mal. *N. lappaceum* L., the Rambutan, is largely cultivated for its fruit (like that of *Litchi*, q.v.). *N. Longana* Cambess., the Longan, and others, are also used. [For *N. Litchi* Cambess. see *Litchi*.]

- Nephrodium** Rich. Polypodiaceae. 250 sp. cosmop. There are 7 Brit. sp., often classed under *Aspidium* or *Lastrea*. *N.* has kidney-shaped indusia, while *A.* has peltate. The best known is *N. Filix-mas* Rich., the common shield-fern. It has a stout, nearly erect rhizome with large pinnate leaves. Branches arise on the leaf bases, but rarely. *N. Filix-mas* var. *cristatum* Moore exhibits apospory, (see Filicineae Leptosporangiateae).
- Nephrolepis** Schott. Polypodiaceae. 7 sp. trop. They produce runners like Strawberry, but not axillary, which take root and give rise to new plants.
- Nephtytis** Schott. Araceae (vi). 2 sp. trop. W. Afr.
- Neptunia** Lour. Leguminosae (i. 4). 8 sp. trop. and sub trop. *N. oleracea* Lour. is found in hot-houses. It has a floating stem, rooting at the nodes, and covered by a curious aerenchyma tissue (p. 172). The leaves are sensitive like those of *Mimosa*. The fls. are in heads, the lower ones being ♂, or neuter with petaloid staminodes.
- Nerine** Herb. Amaryllidaceae (i). 10 sp. Cape Colony.
- Nerium** Linn. Apocynaceae (ii. 4). 3 sp. Medit. to Japan. *N. Oleander* L. is the oleander. It has curious pits on the lower surface of the evergreen leaves, in which the stomata are sunk (several in each) and covered with hairs, thus reducing transpiration. The fls. are suited to long-tongued moths.
- Nertera** Banks et Soland. Rubiaceae (ii. 17). 6 sp. Andes, N. Z., Austr., Sandw. Is., Malaya.
- Nesaea** Comm. ex Juss. Lythraceae. 27 sp. Afr., Austr., As., N. Am.
- Neslia** Desv. Cruciferae (iv. 14). 1 sp. Eur., As.
- Nestlera** Spreng. Compositae (iv). 10 sp. Cape Colony.
- Neurada** Linn. Rosaceae (iv. 11). 1 sp. Medit. to E. Ind.
- Nicandra** Adans. Solanaceae (i). 1 sp. Peru, *N. physaloides* Gaertn. The ovary is divided in an irregular way by the placentae. The berry, which is nearly juiceless and has  $\infty$  seeds, is quite enclosed in the enlarged calyx.
- Nicotiana** Linn. Solanaceae (iv). 40 sp. Am., Polynes., 1 Austr. *N. Tabacum* L. is the chief source of tobacco, which consists of the dried and prepared leaves. *N. rustica* L. and others, are also used.
- Nidularium** Lem. = Karatas Adans.
- Nierembergia** Ruiz et Pav. Solanaceae (iv). 20 sp. extratrop. Am.
- Nigella** (Tourn.) Linn. Ranunculaceae (2). 16 sp. Medit., often cultivated as ornamental plants (love-in-a-mist, devil-in-a-bush). Annual herbs. Alternating with the calyx is an involucre of 5 leaves. Within the coloured calyx are 5—8 nectaries, curious pocket-like structures with lids which prevent small insects from reaching the honey. The cpls. are more or less completely united but have separate styles; they give rise to a capsular fruit. The flr. is protandrous; the styles at first stand straight up out of reach of the sta., but later on bend downwards over the nectaries.

**Nigritella** Rich. = *Habenaria* Willd. [See *Alpenblumen*, p. 66.]

**Nipa** Thunb. *Palmae* (v). 1 sp., *N. fruticans* Thunb., trop. Old World, a low-growing palm with monœcious infl. Fruits woody, combined into a dense head; each contains one seed. It grows in brackish water and is a very characteristic plant upon large areas of the trop. coasts (p. 189). [See *Phytelephas*.]

**Nivenia** Vent. = *Aristea* Soland.

**Nolana** Linn. *Nolanaceae*. 20 sp. Chili, Peru. Many are shore plants (p. 187) with fleshy leaves. The length of the sta. and style varies considerably in different flrs. (see Darwin's *Forms of Flrs.* p. 261).

**Nolanaceae**. Dicotyledons (*Sympet. Tubiflorae*). 3 gen. with 30 sp., W. coast of S. Am. Herbs or low shrubs with simple leaves, often covered with glandular hairs. The leaves in the vegetative region are alt., but in the infl. portion they become paired in the same way as in *Solanaceae* (q.v.). Many of the order are sea-shore plants with fleshy leaves (p. 187). Flrs. solitary in the leaf-axils, ♂, regular. K (5); C (5); A 5, alt. with petals. Cpls. typically 5, only united in Alona, usually free and divided by irregular longitudinal constrictions into 5 or 10 portions standing in a row, or by longitudinal and transverse constrictions into 10—30 portions in 2 or 3 rows. The fruit consists of a corresponding number of 1—7-seeded nutlets. Stipe 1. Seed albuminous. *Genera*: *Nolana*, *Alona*, *Dolia*. United to *Convolvulaceae* by Benth-Hooker; placed in *Personatae* by Warming.

**Nolina** Michx. *Liliaceae* (v1). 10 sp. South-west of N. Am. Xerophytes with the habit of *Dasyllirion*.

**Nonnea** Medic. *Boraginaceae* (iv. 3). 30 sp. Medit.

**Nopalea** Salm-Dyck. *Cactaceae* (11). 3 sp. Cent. Am. Very similar to *Opuntia*. *N. coccinellifera* Salm-Dyck is the plant upon which the cochineal insect (*Coccus cacti*) is cultivated, chiefly in the Canaries &c. It has no thorns.

**Norantea** Aubl. *Marcgraviaceae*. 14 sp. trop. Amer. All the flrs. are fertile, and have saccate nectariferous bracts. The plant resembles *Philodendron* in habit. Placed in *Ternstroemiaceae* by Benth.-Hooker.

**Nothochlaena** R. Br. *Polypodiaceae*. 30 sp. trop. and temp.

**Nothofagus** Blume = *Fagus* Tourn.

**Nothopanax** Miq. = *Panax* Linn.

**Nothoscordum** Kunth. *Liliaceae* (iv). 10 sp. China, Am. Adventitious embryos are formed by budding of the nucellus tissue round the embryo-sac (cf. *Funkia*).

**Nuculiferae** (Warming). The 6th cohort of *Sympetalae* (p. 146).

**Nudiflorae** (Benth-Hooker). The 5th series of *Monocotyledons* (p. 145).

**Nuphar** Sibth. et Sm. *Nymphaeaceae* (111). 7. sp. N. Hemisph. *N. luteum* Sibth. et Sm. is the common yellow water-lily or brandy-

bottle; *N. pumilum* DC. is also found in Brit. The vegetative habit is that of *Nymphaea* (q.v.). The flr. projects a little above the water, and is fully hypogynous. At the base of the peduncle is a rudimentary bract. There are 5 large coloured outer perianth leaves, quincuncial, the fourth being anterior. Within these are the 'petals,' 13 in number arranged in a 5/13 spiral. Then follow  $\infty$  sta., the outer 13 alternating with the petals, the next 13 with them, and so on in a spiral. In the centre is the superior gynœceum, syncarpous, with 10—16 loculi. Stigmas, ovules, &c., as in *Nymphaea*. The fruit is a large berry; it breaks off from the stalk and splits up into separate cpls. The seeds have no aril like those of *Nymphaea*, but the slimy pericarp contains air bubbles: the seeds are set free by its gradual decay, and sink to the bottom.

**Nuttallia** Torr. et Gray. Rosaceae (v. 12). 1 sp. N. W. Am. Like *Prunus*, but with 5 free cpls.

**Nyctaginaceae.** Dicotyledons (Archichl. Centrospermae). 20 gen. with 160 sp., mostly trop. and esp. Am. Trees, shrubs or herbs with opp. (often unequal) leaves and no stipules. Flrs. in cymes, ♂ or unisexual, and presenting much variety in structure. At the base of the flrs. are usually several bracts, often large and coloured. In *Bougainvillea* 3 large conspicuous bracts enclose a group of 3 flrs. In *Abronia* the number of bracts and flrs. is larger, while in *Mirabilis* there is only one flr. and the involucre resembles a calyx. P usually (5), petaloid, persistent upon the ripe fruit; usually the upper part drops away and the fruit remains in the lower part, which is termed the *anthocarp*, and may become glandular, or form an umbrella-like wing, or otherwise serve for seed-dispersal. Sta. typically 5, alt. with the perianth, but often 3, 8, 10 or other numbers, or raised to 20 or 30 by branching; filaments often of unequal length. Ovary of 1 cpl., superior, with a long style and 1 basal erect ana-campylotropous ovule. Fruit an achene enclosed in the perianth. The N. are of slight economic value; see *Mirabilis*, *Neea*, &c.

*Classification and chief genera* after Heimerl):

A. Ovary glabrous: style present; sta. 1—30.

1. *Mirabileae* (perianth enlarging after fertilisation; shrubs and herbs; ♂): *Mirabilis*, *Allionia*, *Bougainvillea*, *Abronia*.

2. *Pisonieae* (as 1 but shrubs and trees; 1-sexual): *Pisonia*, *Neea*.

3. *Boldoeae* (perianth not enlarging; herbs; ♂): *Boldoa*.

B. Ovary hairy; no style: sta. 2—3.

4. *Leucastereae*: *Leucaster*, *Reichenbachia*.

[Placed in *Curvembryae* by Benth.-Hooker and Warming. See art. *Caryophyllaceae* for relationships.]

**Nyctagineae** (Benth.-Hooker) = *Nyctaginaceae*.

**Nycterinia** D. Don = *Zaluzianskya* F. W. Schmidt.

**Nymphaea** (Tourn.) Linn. (*Castalia* Salisb.). *Nymphaeaceae* (III). 32 sp. trop. and temp. *N. alba* L., the white water-lily, in Brit. Many



sp. are cultivated in our water-lily houses, e.g. *N. Lotus* L. sometimes supposed to be the sacred lotus of Egypt (see *Nelumbium*). They grow in shallow water. There is a stout rhizome creeping on the earth, with roots on the underside. At the tip it is bent upwards, and bears stipulate leaves and flrs. on long stalks. The peduncle occupies the position of one of the leaves of the spiral, and there is no bract at its base. The leaf is large and floats on the surface of the water; as is usual in such cases it is nearly circular, entire, and leathery, with stomata and cuticle and palisade tissue on the upper side. In very deep water ribbon-like submerged leaves are sometimes formed, and seedlings always produce such leaves at first (see p. 168).

The flr. is ♂, regular, acyclic, and floats on the surface of the water; where it is visited by insects. The outermost floral leaves, 4 in number, exhibit a peculiar aestivation, the anterior being entirely outside, the posterior inside the lateral leaves. According to Caspary (*Eichler, Blüthendiag.* II. 184) the anterior leaf represents the bract ('adnate' to the peduncle; cf. *Solanaceae*), the two lateral leaves the bracteoles, the posterior a true sepal. Most authors regard the 4 leaves as a calyx, but the morphology is, in either case, very peculiar. The corolla is well developed; there are 4 outer petals alternating with the sepals, and 4 inner alternating with the outer. These 8 form the starting points of as many spirals of petals, usually 4 in each, alternating approximately with the outer 8 and with one another. As we pass inwards the petals become narrower and show transition forms to the sta., which to the number of 50 or 100 continue the flr. inwards. Whilst the calyx is hypogynous the petals and sta. are inserted up the sides of the gynœceum, which is syncarpous, with 10-20 loculi, each containing ∞ ovules scattered over the whole carpellary surface (cf. *Butomus*). The sessile stigmas form a number of rays upon the upper surface of the gynœceum, as in a poppy. The fruit is a large berry containing numerous seeds, each of which is covered by a spongy aril. Between the aril and the seed are air-bubbles. The fruit ripens under water and when it dehisces the mass of seeds floats up to the surface; there the individual seeds part company, each drifting about until the air escapes (by decay of the aril or otherwise), when it sinks to the bottom of the pond. There is a large perisperm round the endosperm proper.

**Nymphaeaceae.** Dicotyledons (Archichl. Ranales). 8 genera with about 60 sp. cosmop. Water or marsh plants usually with rhizomes, and with submerged, floating, and aerial leaves (see p. 171 and cf. the genera) and solitary usually large flrs. These show a great variety of pattern. *Cabomba* is most simple and agrees in type with the other orders of Ranales; whilst in *Nuphar*, *Nymphaea*, *Victoria*, *Nelumbium*, &c., great modification appears, especially in the gynœceum. In *Nelumbium* the ovary is still apocarpous, though the cpls. are connected by the curious torus, whilst in the other genera it is syncarpous; in

Nuphar it is superior, in Nymphaea semi-inferior, in Victoria inferior. The perianth too shows much variety, from the simple Cabomba-type to Nuphar, &c. The ovules are usually anatropous. The seed has both endosperm and perisperm (exc. Nelumbium), and is often arilate. For full details of the floral structure see the chief genera, and Eichler's *Blüthendiag.*

*Classification and genera* (after Caspary):

- I. *NELOMBONOIDEAE* (seed exalbuminous; cpls. free in obconical receptacle): Nelumbium (only genus).
  - II. *CABOMBOIDEAE* (endosperm and perisperm; cpls. free): Cabomba, Brasenia.
  - III. *NYMPHAEOIDEAE* (do., but cpls. united): Victoria, Euryale, Nymphaea, Nuphar, Barclaya.  
[Placed in Ranales by Benth.-Hooker, in Polycarpiceae by Warming.]
- Nyssa** Gronov. ex Linn. Cornaceae. 6 sp. N. Am., Himal., Malaya. *N. multiflora* Wangenb. and others in N. Am. (Tupelo, Pepperidge, Gum-tree) yield timber and edible fruit.
- Oberonia** Lindl. Orchidaceae (8). 50 sp. trop., exc. Am.
- Obione** Gaertn. = *Atriplex* Linn.
- Obolaria** Linn. Gentianaceae (1, 2). 1 sp. N. Am. Saprophyte (cf. *Bartonia*) of a purplish green colour with scaly leaves (p. 195).
- Ochna** Linn. Ochnaceae. 30 sp. trop. As., Afr., Cape Col. The calyx is coloured. Cpls. 3—15, free below, but with a common style. After fertilisation the style falls off and each cpl. gives rise to a drupe, while at the same time the receptacle becomes fleshy underneath them. The leaf is a good one for showing veining.
- Ochnaceae**. Dicotyledons (Archichl. Parietales). 17 gen. with 210 sp., trop. Most are trees or shrubs with alt. usually simple stip. leaves, and panicles, racemes or cymes (*Sauvagesia*, &c.) of  $\sigma$ , usually regular flrs. K 5, free or united at base, imbricate; C 5, rarely 10, contorted; A 5, 10, or  $\infty$ , hypogynous or on an elongated axis;  $\bar{G}$  (2—5), rarely (10—15), often free below with common style (cf. *Apocynaceae*). Ovules 1—2— $\infty$  in each cpl., erect or rarely pendulous, always with ventral raphe. The axis swells and becomes fleshy under the fruit, which is usually a cluster of drupes, but sometimes a berry or capsule. Endosperm or not. *Chief genera*: *Ochna*, *Gomphia*, *Sauvagesia*. Benth.-Hooker place Ochnaceae in Geraniales, but unite *Sauvagesia* and its allies to *Violaceae*. Warming places O. in *Terebinthinae*, also placing the *Sauvagesieae* in *Violaceae*.
- Ochroma** Sw. Bombacaceae. 1 sp. trop. Am., W. Ind., *O. Lagopus* Sw. the Bolsa or corkwood. The wood is very light and is used for floats, canoes, &c. The seeds are embedded in hairs.
- Ocimum** Linn. Labiatae (VII). 45 sp. trop. and warm temp. *O. Basilicum* L. is the basil.
- Ocotea** Aubl. Lauraceae (1). 200 sp. trop. and subtrop. *O. bullata* E. Mey. (S. Afr.) yields a useful timber.

**Odontites** (Riv.) Hall. = Bartsia Linn. *O. serotina* Dum. (*O. vulgaris* Moench) = *B. Odontites*.

**Odontoglossum** H. B. et K. Orchidaceae (28). 100 sp. Mts. of trop. Am. Epiphytes. Many are hot-house favourites.

**Odontospermum** Neck. (incl. *Asteriscus* Moench). Compositae (iv). 12 sp. Medit. *O. (A.) pygmaeum* O. Hoffm. is a curious little xerophyte whose fruit-heads close in dry weather (cf. *Anastatica*, *Mesembryanthemum*); the seeds only escape in damp weather suitable for germination.

**Oenanthe** (Tourn.) Linn. Umbelliferae (6). 35 sp. N. Hemisph., S. Afr., Austr. 7 in Brit. (water drop wort).

**Oenothera** Linn. (incl. *Godetia* Spach, *Onagra* Tourn., *Xylopleurum* Spach). Onagraceae (iv). 60 sp. Am. *O. biennis* L., the evening primrose, and many others, are favourite garden plants. The fls. of *O. biennis* emit their scent in the evening and are visited by nocturnal moths, to which they are adapted by their long tubes (p. 67).

**Oenotheraceae** (Warming) = Onagraceae

**Olacaceae**. Dicotyledons (Archichl. Santalales). 25 gen. with 120 sp., trop. Most are shrubs or trees with small ♂ fls. There is a distinct calyx, resembling the calyculus of Loranthaceae, but probably not equivalent to it. Petals 4—6. Sta. as many or 2 or 3 times as many. Ovary partly sunk in the disc, or free, 2—5 loc. at base, 1 loc. above, with free placenta and 1 ovule hanging down into each loc. (occasionally it is 1-loc. 1-ovuled). Drupe or nut, one-seeded. Seed with testa and endosperm. *Chief genera* *Ximenia*, *Olex*. Benth.-Hooker unite Icacinaceae to *O.* and place the order in Olacales; Warming places it in Hysterophyta.

**Olacales** (Benth.-Hooker). The 8th cohort of Polypetalae (p. 142).

**Olacineae** (Benth.-Hooker) = Olacaceae + Icacinaceae.

**Olex** Linn. Olacaceae. 30 sp. trop. Old World.

**Oldenlandia** Linn. (excl. *Hedyotis* Linn.) Rubiaceae (i. 2). 80 sp. trop. Some are heterostyled (dimorphic).

**Olea** (Tourn.) Linn. Oleaceae (i. 3). 30 sp. Medit., S. Afr., E. Ind., Austr., Polynes. *O. europaea* L. is the olive tree, cultivated in the Medit. region from early ages. The wild form has thorny twigs and a small fruit, the cultivated form (var. *sativa* DC.) is smooth and has a large drupe with oily flesh. The oil is obtained by a process of bruising and pressing the fruit. Olive oil is now largely adulterated with cotton-seed oil, the oils of *Arachis*, *Sesamum*, *Juglans*, &c., imported into Italy for the purpose.

**Oleaceae**. Dicotyledons (Sympet. Contortae) 21 gen. with 390 sp. trop. and warm temp., esp. E. Ind. They are shrubs and trees usually with opp. leaves, which are exstip., simple or pinnate, often entire. Serial accessory buds occur in the leaf-axils of many sp. (e.g. *Syringa*) in both flowering and vegetative parts. The inf. is racemose or cymose, often bracteolate. Fls. ♂, rarely unisexual, regular,

2—6-merous, sometimes poly- or a-petalous (*Fraxinus*, &c.). K typically (4), valvate; C (4) valvate or imbricate, rarely convolute. Sta. 2, epipetalous usually transversely placed, and alt. with cpls. No disc.  $\bar{G}$  (2); stigma 2-lobed on simple style; ovary 2-loc. with 2 anatropous ovules in each loc. Fruit a berry, drupe, or capsule, or schizocarp, with 1—4 seeds. Endosperm or none, embryo straight. *Olea*, *Fraxinus*, &c., are of economic value.

*Classification and chief genera* (after Knoblauch):

- I. *OLEOIDEAE* (seeds pendulous; fruit not constricted):
  1. *Fraxineae* (samara): *Fraxinus*.
  2. *Syringaceae* (loculicidal capsule): *Forsythia*, *Syringa*.
  3. *Oleineae* (drupe or berry): *Phillyrea*, *Olea*, *Ligustrum*.
- II. *JASMINOIDEAE* (seeds usually erect; fruit constricted vertically): *Jasminum*.

[*Jasminoideae* are sometimes classed as a separate family, but their characters are not very constant, and all of them occur occasionally in *Oleoideae*. Benth.-Hooker place O. in Gentianales, Warming in Contortae.]

**Oleandra** Cav. Polypodiaceae. 6 sp. trop.

**Olearia** Moench. Compositae (III). 90 sp. Austr., N.Z., Auckland Is. The genus replaces *Aster* in these regions, and closely resembles it. They are, however, all trees or shrubs.

**Olinia** Thunb. Oliniaceae. 6 sp. Afr.

**Oliniaceae**. Dicotyledons (Archichl. Thymelaeales). Only genus *Olinia*.

See *Nat. Pfl.* for details. Placed in Lythraceae by Benth.-Hooker.

**Omphalea** Linn. Euphorbiaceae (A. II. 7). 10 sp. trop. Am., 1 Madag.

**Omphalodes** Tourn. ex Moench. Boraginaceae (IV. 1). 24 sp. Eur., As., Mexico. The borders of the achenes are inrolled, so that each fruit is boat-shaped.

**Onagra** (Tourn.) Adans. = *Oenothera* Linn.

**Onagraceae**. Dicotyledons (Archichl. Myrtiflorae). 36 gen. with 470 sp., chiefly N. temp. (see *Epilobium*). Most are perennial herbs, a few shrubs or trees. Leaves alt., opp., or whorled, simple, rarely stip. Flrs. solitary in the leaf-axils or in spikes, racemes or panicles,  $\bar{g}$ , regular or zygomorphic, usually 4-merous (sometimes 2—5). The ovary is inferior and the axis is prolonged beyond it into a tube ('calyx-tube'). K 4, valvate; C 4, usually convolute; A 4+4, or 4, 2, or 1.  $\bar{G}$  (4), 4-loc. with axile placentae and  $\infty$  anatropous ovules; the septa are commonly imperfect below; style simple. The flrs. are mostly adapted to bees or Lepidoptera and are often markedly protandrous; those of sp. of *Lopezia* are explosive. Fruit usually a loculicidal capsule, sometimes a nut or berry. Seeds exalbuminous. Many are cultivated as ornamental flowers.

*Classification and chief genera* (after Raimann):

- A. Fruit an  $\infty$ -seeded capsule. Axis not prolonged above ovary. Bracteoles present.

- I. *Jussieuaceae*: Jussieu, Ludwigia.
- B. Capsule as above. Axis prolonged. No bracteoles.
  - II. *Epilobieae* (seed with hairy tuft): Zauschneria, Epilobium.
  - III. *Hauyeae* (seed with flat wing): Hauya (only genus).
  - IV. *Onagreae* (seed naked or with membranous edge or with small crown): Clarkia, Oenothera.
- C. Nut. 1—4 seeds. Axis prolonged. No bracteoles.
  - V. *Gaureae*: Gaura.
- D. Berry. Axis as in C. No bracteoles.
  - VI. *Fuchsiae*: Fuchsia (only genus).
- E. Capsule. Sta. 1 or 2. No bracteoles.
  - VII. *Lopeziae*: Lopezia.
- F. Nut, hooked. Flr. dimerous.
  - VIII. *Circaeae*: Circaea (only genus).

[Benth.-Hooker unite Trapa to O. and place the order in Myrtales; Warming places it in Myrtiflorae.]

**Oncidium** Sw. Orchidaceae (28). 300 sp. trop. Am. Epiphytes (p. 184). Some sp., e.g. *O. Papilio* Lindl., have flat tubers which make humus-collecting niches against the support; others have fleshy leaves and no tubers.

**Onobrychis** Linn. Leguminosae (III. 7). 80 sp. temp. Eur., As. Floral mechanism as in Trifolium. *O. sativa* Lam. is the sainfoin, one of the best forage plants for a chalky soil.

**Onoclea** Linn. Polypodiaceae. 3 sp. N. Hemisph.

**Ononis** Linn. Leguminosae (III. 4). About 80 sp. Medit., Eur. (3 in Brit.—rest-harrow). Shrubs and herbs, sometimes with thorny lateral branches. The mechanism of the flrs. is intermediate between that of Lotus and that of Trifolium. At first the upper edges of the keel cohere, and the pollen is squeezed out at the tip as in Lotus; afterwards the keel splits and the anthers emerge as in Trifolium. Cleistogamic flrs. occur in some sp.

**Onopordon** Linn. Compositae (XI). 20 sp. Eur., N. Afr., W. As. *O. Acanthium* L., the cotton thistle, in Brit. Leaves decurrent. Flr. as in Cnicus.

**Onosma** Linn. Boraginaceae (IV. 4). 70 sp. Medit., Himal.

**Onychium** Kaulf. Polypodiaceae. 4 sp. subtrop.

**Ophelia** D. Don = *Swertia* Linn.

**Ophioglossaceae**. Filicineae Eusporangiatæ. 3 gen. with 17 sp. trop. and temp. They are all small herbaceous plants, some tropical species being epiphytic; there is a short slender rhizome bearing roots in acropetal succession, and giving off leaves which project above the soil. The leaf bases are usually fleshy and fit closely together concealing the stem. The leaf splits into a dorsal and a ventral part, the former being the 'sterile' green blade, the latter the 'fertile' sporangiferous spike, often much branched and containing

the sporangia sunk in its tissues. The spores are all of one kind and give rise, as far as known, to subterranean colourless prothalli, living saprophytically. *Genera*: *Ophioglossum* (sporangia sessile, in two rows, forming a narrow close spike), *Botrychium* (sporangia in small crested clusters forming a long loose spike), *Helminthostachys* (sporangia sessile in two rows on face of spikes which form a compound panicle).

**Ophioglossum** Linn. Ophioglossaceae. 9 sp. trop and temp. *O. vulgatum* L., adder's-tongue, is found in Brit. The leaves are developed very slowly, one appearing above the soil each year. Adventitious buds are formed on the roots and thus the plant multiplies vegetatively. The sporangiferous spike is usually unbranched, except in *O. palmatum* L. where "instead of a single spike there are a number arranged in two rows along the sides of the upper part of the petiole and the base of the lamina." (This sp. and *O. pendulum* L. are epiphytic.) The roots are in a very definite relation to the leaves, one appearing at the base of each; they are commonly unbranched.

**Ophiopogon** Ker-Gawl. Liliaceae (VIII). 4 sp. Japan, China. The mucilaginous tubers of *O. japonicus* Ker-Gawl. are edible. [Hæmodoraceae Benth.-Hooker.]

**Ophiorrhiza** Linn. Rubiaceae (I. 2). 50 sp. trop. As., Indo-mal.

**Ophiurus** Gaertn. f. Gramineae (II). 4 sp. trop. Included in *Rottboellia* in *Nat. Pfl.*

**Ophrys** Linn. Orchidaceae (3). 30 sp. Eur., W. As., N. Afr. (*O. apifera* Huds., bee-orchis, *O. aranifera* Huds., spider-orchis, *O. muscifera* Huds., fly-orchis, in Brit.). Terrestrial herbs with the habit and floral characters of Orchis. *O. apifera* is one of the few self-fertilising orchids. If the pollinia are not removed by insects (as in Orchis) they drop out of the anther and dangle on their long caudicles in front of the stigma, against which they get blown or knocked (see Darwin).

**Oplismenus** Beauv. Gramineae (V). 5 sp. trop. and sub trop.

**Opopanax** Koch. Umbelliferae (7). 2 sp. Medit. Gum opopanax is obtained from incisions in the roots. It is used in perfumery.

**Opuntia** Tourn. ex Mill. Cactaceae (II). 200 sp. Am. Fleshy stemmed plants, usually with small fleshy leaves, which drop off very early (see or ler). In *O. subulata* Engelm. the leaves are large and do a good deal of assimilation. Some, e.g. *O. Stapeliae* DC., have mammilla-like cushions; *O. brasiliensis* Haw. has the main stem cylindrical and the lateral ones flat; most sp. have all the stems flattened, e.g. *O. vulgaris* Mill. (prickly pear), *O. Ficus-indica* Mill. (Indian fig), &c. (see Goebel's *Pflanzenbiol. Sch.* 1. p. 73 seq.). The leaves of the lateral shoots usually form groups of thorns, but in *O. diademata* Lem. are ribbon-like and scaly. Many are vegetatively propagated by the detachment of branches, e.g. *O. fragilis* Haw., which rarely flowers at all. The fruits of prickly pear &c. are edible; some are

used for hedge-making, others as food for cochineal-insects (see Nopalea). [For *O. coccinellifera* Steud. see Nopalea.]

**Opuntiales.** The 20th cohort of Archichlamydeae (p. 139).

**Orchidaceae.** Monocotyledons (Microspermae). Over 400 gen. with 5000 sp. cosmop., abundant in trop., rare in arctic regions. They agree in some general features of habit, &c., e.g. they are all perennial herbs, but differ widely in detail, owing to the diversity of conditions in which they exist—land-plants, epiphytes, saprophytes, &c. Within the tropics they form an important feature of the vegetation, living chiefly as epiphytes (p. 184). Most of the temperate forms are terrestrial.

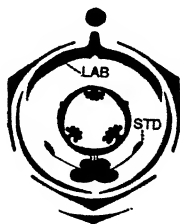
The plant as a whole may be built up in one of three ways. It may be (1) a monopodium, the main axis growing steadily on, year after year, and bearing the fls. on lateral branches; (2) an *acranthous* sympodium, the main axis being composed of annual portions of successive axes, each of which begins with scale leaves and ends in an infl.; (3) a *pleuranthous* sympodium, where the infls. are borne on lateral axes, the shoot which for the current year continues the main axis, simply stopping short at the end of its growing period, and not ending in an infl. [see p. 35]. These three types of construction are used in the classification of the order (see below).

The saprophytic orchids are but few; they have no green leaves; below the soil, in the humus, is a fleshy rhizome, with (*Neottia*) or without roots. The rhizome is much branched, and does part or all of the work of absorption. Mycorhiza (p. 23) occurs in most or all. The terrestrial forms are all sympodial, and have usually a rhizome; each annual shoot bends up into the leafy shoot of the current year. Many being xerophytic, and all perennial, it becomes a necessity that there should be a storage reservoir to last over the non-vegetative period of the year. In a great many sp. this reservoir takes the form of a thickened internode of the stem: in many sp. again, among which the Brit. orchids are included, the bud for the next year's growth, i.e. the next part of the sympodium, is laid down at the base of the stem, and from it is developed a thick and fleshy adventitious root, forming a large tuber, which lasts over the winter.

Coming lastly to the epiphytic orchids, which occur in great numbers in the tropics, we find a great variety of forms. [See Schimper, *Die epiphytische Vegetation Amerikas.*] They are mostly of sympodial structure, but the few monopodial orchids also belong to this group. The exceedingly light seeds and the xerophytic habit of many orchids fit them to become epiphytes. The roots of the epiphytic forms are of some interest. In the first place, to fasten the plant to its support there are 'clinging' roots, insensitive to gravity, but negatively heliotropic. The niche between the plant and its support and the network formed by the roots act as reservoirs for humus, and into this project 'absorbing' roots, branches from the others; these are usually,

Schimper asserts, negatively geotropic. Finally there are the true aerial roots which hang down in long festoons. The outer layers of cells (the epidermis and *velamen*) are dead and perforated, and act as a sponge to absorb water trickling down over them. Their internal tissue is green (as may be seen on wetting a root) and assimilates. During the dry season a great proportion of the orchids drop their leaves (though they may flower), and 'hibernate' in the condition of fleshy *pseudobulbs*. One pseudobulb, which is a thickened stem-internode, is usually formed each year. In this, water and other reserves are stored. Those epiphytic orchids which do not form these tubers have fleshy leaves which serve the same end. It may be noted that the fleshy leaved orchids, *e.g.* *Vanilla*, have usually a very feebly developed velamen. Lastly in this connection may be mentioned some of the monopodial forms which have no green leaves at all, assimilating either by the surface of the stem, or by the long dangling aerial roots (*Polyporrhiza*, &c.).

The infls. are of racemose construction, very often spikes, which look like racemes, the long inferior ovary resembling a stalk. The flr. is irregular and departs very far from the ordinary Monocotyledon type. There are two chief divisions of O., with different flrs., the *Monandreae* and the *Diandrae*, with 1 and 2 sta. respectively; the great majority are monandrous. Perianth in 2 whorls, epigynous, petaloid. The posterior petal is usually larger than the rest, and is termed the *labellum*: by the twisting (*resupination*) of the ovary through  $180^\circ$  it comes round to the anterior side of the flr. and forms a landing place for insects. In many O. its structure is exceedingly complex in connection with the pollination-mechanism of the flr. The essential organs of the flr. are all comprised in a central structure by which the O. can be recognised at a glance, *viz.* the *column*, which consists in the simpler cases of the combined style and sta. (to use the old-fashioned expression; in reality it is very probably an outgrowth of the axis, bearing the anther and stigmas at the top). In the monandrous forms the column exhibits one anther and two fertile stigmas (often  $\pm$  confluent), together with a special organ, the *rostellum*, which represents the third stigma. The single anther is the anterior one of the outer whorl (if we imagine the flr. of O. derived from a typical 3-merous flr.); the other two of this whorl are entirely absent, and also all those of the inner whorl, though in some genera, *e.g.* *Orchis*, the anterior two are represented by staminodes upon the sides of the column. The two fertile stigmas are the posterior pair, and the third (anterior) is represented by the rostellum (in using the



Floral diagram of *Orchis*, before resupination (after Eichler, modified); LAB = labellum, STD = staminode.



terms anterior and posterior, the resupination is supposed not to have occurred).

The various organs face the labellum, and, if the flr. of a simple O., e.g. *Orchis*, be examined, they can easily be made out. A little above the base may be seen the two stigmas, then above these a projecting point, the rostellum, and above this again, and behind it, forming the apex of the column, is the anther, which shows two lobes. Each of these is occupied by a *pollinium*, or mass of pollen. Under the microscope the grains of pollen are seen to be tied together in packets by elastic threads; the threads unite at the base of the pollinium and form a cord, the *caudicle*, which runs down into, and is attached to part of the rostellum.

The simple construction found in *Orchis* &c., as thus described, is replaced by much more complex arrangements in many sp. The labellum itself may be rendered very complex, by the addition of spurs and other outgrowths; very often outgrowths of the summit of the receptacle take place, displacing some of the organs, thus for example in *Drymoda* and others, the labellum and the sepals on either side of it are carried forward on an axial protuberance in such a way that the sepals appear to spring from the labellum, the axial growth (*chin*) appearing like the basal part of this organ. Some of these constructions are very complex. Several are described in connection with the genera to which they belong, but for details reference must be made to *Nat. Pfl.*

Similarly the column shows great variety in structure, for details of which refer as above. One point may be mentioned specially as of importance in classification. In the simple case of *Orchis* &c., described above, the *base* of the anther loculi is against the rostellum; such cases are called *basitonic*; in others it is the *apex* that is next the rostellum (*Oncidium*, &c.), and these are *acrotonic*.

[*Diandrae*. So far only monandrous forms have been considered. In *Cypripedium* and its allies the column has 2 anthers, no rostellum, and a simple stigma, composed of the 3 carpellary stigmas. The two sta. belong to the inner whorl, and the sta. which in *Monandrae* is fertile, is here represented by a large staminode. The stigma is not sticky, but the pollen is, and it is not combined into pollinia.]

The ovary is inferior in all O., unilocular with 3 parietal placentae (exc. *Apostasia*), and very numerous ovules, which do not develop until fertilisation of the flr. occurs.

The adaptations of orchid flowers to *fertilisation* by insects are endless, and many very complicated. Reference must be made to text-books for the details. No student should omit to read Darwin's *Fertilisation of Orchids*, at least the first two and the last chapters. In it will be found accounts of the mechanism of most of the common genera. A few general points only can be mentioned

here; in the description of the individual genera other more detailed features are treated. Very few of the order secrete free honey; in most cases the insect has to bite into or drill the tissue for the juice therein contained; this tissue is usually part of the labellum—often a spur at the base—or the basal part of the column. The pollinia are removed as a rule when the insect is going out of the flr. In most cases the insect in entering displaces the rostellum or some portion of it, and thereby exposes and comes into contact with a sticky mass (due to disorganisation of cells formerly living). This becomes cemented to the insect while it is drilling for honey, and as the insect goes out again it takes with it the viscid lump, together with the pollinia, either merely glued to it, or attached by caudicles. In many cases the pollinia are in such a position that when the insect enters the next flr. they will touch the stigmas. In others this is not so, e.g. *Orchis*, where the anthers and stigma are far apart on the column, and in such cases the pollinia, on getting out of the anther, execute a hygroscopic movement which brings them into the proper position on the insect's body to strike the stigmas. Such is the general principle of the orchid mechanism, but the variety in detail is endless. Many flrs. have the most extraordinary devices, e.g. *Coryanthes*, *Stanhopea*, *Vanda*, &c. See under individual genera.

The *fruit* is a capsule, containing usually a gigantic number of exceedingly small and light seeds, which are well suited to wind distribution (hence, among other causes, the epiphytic habit of so many of the order). It may be noted that, as Darwin has pointed out, this production of immense numbers of seeds is an evidence of lowness of organisation, and contradicts the impression that would otherwise be derived from the floral complications.

The O. are favourites in horticulture, but *Vanilla* is the only one of economic importance.

*Classification and chief genera* (after Pfitzer):—

A. DIANDRAE (two stamens).

1. Apostasiinae: *Apostasia*.
2. Cyripedilinae: *Cypripedium*.

B. MONANDRAE (one stamen).

- a. *BASITONAE* (basitonic, anther not falling off):
3. Ophrydinae: *Ophrys*, *Orchis*, *Habenaria*, *Disa*.
- b. *ACROTONAE* (acrotonic, anther usually falling easily):
  - a. *ACRANTHAE* (acranthous sympodial):
    - I. *Convolutae* (leaves convolute in bud, with no distinction between blade and sheath):
    4. Neottiinae: *Vanilla*, *Epipactis*, *Neottia*.
    - II. *Articulatae* (as I., but with a joint between blade and sheath):
    5. Thuniinae: *Thunia*, *Trichosma*.
    6. Coelogykinae: *Coelogyne*, *Pholidota*.

7. Collabiinae: Collabium.

**III. Duplicatae** (leaves folded in bud) :

8. Liparidinae: Liparis, Corallorhiza.  
9. Polystachyinae: Galeandra.  
10. Podochilinae: Podochilus.  
11. Glomerinae: Ceratostylis.  
12. Pleurothallidinae: Masdevallia, Pleurothallis.  
13. Laeliinae: Epidendrum, Cattleya, Laelia.  
14. Sobraliinae: Sobralia.

**β. PLEURANTHAE** (pleuranthous sympodial) :

**I. Convolutae** (leaves convolute in bud) :

15. Phajinae: Phajus, Calanthe.  
16. Cyrtopodiinae: Lissochilus.  
17. Catasetinae: Mormodes, Catasetum.  
18. Lycastinae: Lycaste.  
19. Gongorinae: Coryanthes, Stanhopea, Gongora.  
20. Zygopetalinae: Zygopetalum.

**II. Duplicatae** (leaves folded in bud) :

**1. Sympodiales** (sympodial).

21. Dendrobiinae: Dendrobium, Eria.  
22. Bolbophyllinae: Drymoda, Bolbophyllum.  
23. Thelasiniae: Thelasis.  
24. Cymbidiinae: Cymbidium.  
25. Thecostelinae: Thecostele.  
26. Steniinae: Stenia.  
27. Maxillariinae: Maxillaria, Scuticaria.  
28. Oncidiinae: Ada, Odontoglossum, Oncidium.  
29. Huntleyinae: Pescatorea.

**2. Monopodiales** (monopodial).

30. Dichaeinae: Dichaea.  
31. Sarcanthinae: Phalaenopsis, Vanda, Angraecum, Polyrhiza, Aerides.

[Placed in Microspermae by Benth-Hooker, in Gynandrae by Warming].

**Orchideae** (Benth.-Hooker) = **Orchidaceae**.

**Orchis** (Tourn.) Linn. (incl. *Anacamptis* Rich., *Himantoglossum* Spreng.). **Orchidaceae** (3). 70 sp. Eur., temp. As., N. Afr., Am. (10 sp. in Britain, of which the most familiar are *O. mascula* L., the early purple orchis, and *O. maculata* L., the spotted orchis). They are sympodial perennials forming one tuber each year (see **Orchidaceae** for description). The fls. stand in a dense spike and have an ingenious mechanism for insect fertilisation. The anther is basitonic and well above the stigmas. The rostellum has an outer firm pouch, inside which is the viscid substance to which are firmly attached the caudicles of the pollinia. An insect entering the flr. probes the spur of the labellum and its back comes into contact with the rostellum and

depresses the pouch. This causes the viscid substance to adhere to the insect. The tissue of the spur has to be drilled for honey, and while this is being done the cement rapidly sets, so that, as the insect leaves the flr., it takes with it the pollinia, standing upright on their caudicles. If they remained in this position they would evidently never touch the stigmas of another flr., but as soon as the caudicles are exposed to air, they contract on the side towards the base of the flr. (i.e. towards the insect's head) and move the pollinia downwards from ! to -. In this position, when the insect enters another flr., they pass under the rostellum and strike the stigmas. [See Darwin's *Orchids* for details of the different sp.]

**Oreodoxa** Willd. Palmae (iv. 6). 6 sp. trop. Am. Monœcious; flrs. in groups of 3, a ♀ between two ♂. *O. oleracea* Mart. is the cabbage palm; the young head of leaves is cut out and eaten. The fruit yields an oil, and a form of sago is obtained from the stem (see *Metroxylon*). *O. regia* H. B. et K. is the royal palm or Palmiste.

**Oreopanax** Dcne. et Planch. Araliaceae. 40 sp. trop. Am.

**Origanum** Tourn. ex Linn. Labiatae (vi. 11). 30 sp. Eur., As., Medit. *O. vulgare* L. (marjoram) in Brit., used as a flavouring herb. *O. Majorana* L. yields oil of marjoram by distillation.

**Orlaya** Hoffm. = *Daucus* Tourn.

**Ornithidium** Salisb. Orchidaceae (27). 20 sp. trop. Am.

**Ornithocephalus** Hook. Orchidaceae (28). 20 sp. trop. Am.

**Ornithogalum** (Tourn.) Linn. Liliaceae (v). 70 sp. temp. Old World. *O. umbellatum* L. (star-of-Bethlehem) in Brit.

**Ornithopus** Linn. Leguminosae (III. 7). 8 sp. Medit., W. As., trop. Afr., S. Brazil. *O. perpusillus* L. in Brit. (bird's foot). *O. sativus* Brot. (*Seradella*, *Serratella*) affords good fodder.

**Ornus** Neck. = *Fraxinus* Tourn.

**Orobanchaceae**. Dicotyledons (Sympet. Tubiflorae). 12 gen. with 125 sp. chiefly N. temp. Old World; a few Am. and trop. All are parasitic herbs with little or no chlorophyll, attached by suckers formed upon their roots to the roots of other plants (the seeds of Orobanche only germinate when in contact with a root of a host). For details see genera and cf. p. 194. Infl. terminal, a raceme or spike (exc. *Phelipaea*, which has a solitary terminal flr.). Flr. ♀, zygomorphic. Calyx hypogynous, gamosepalous, with 2—5 teeth. Corolla (5), imbricate, 2-lipped. Sta. 4, didynamous, epipetalous; anthers opening longitudinally.  $\bar{G}$  usually (2), rarely (3), 1-loc. Placentae parietal, often T-shaped in section or branched. Ovules  $\infty$ , anatropous. Style 1. Loculicidal capsule. Seeds small, with minute undifferentiated embryo in oily endosperm. *Chief genera*: Orobanche, Christisonia, Lathraea, Phelipaea. Placed in Personales by Benth.-Hooker; Warming unites O. to Gesneraceae, with which they have much in common.

**Orobanche** (Tourn.) Linn. Orobanchaceae. 90 sp. temp. and subtrop.;

7 in Brit. (broom-rape). They are parasitic by their roots upon the roots of other plants, and have no green tissue of their own (p. 195). *O. ramosa* L. is common on hemp. *O. major* L. (*O. elatior* Sutton) on Centaurea &c. (in Brit.), *O. minor* Sutton on Clover. Some are confined to one host, e.g. *O. Hederae* Duby to ivy, others are more general in their attacks.

**Orobanch** (Tourn.) Linn. = Lathyrus Tourn. *O. hirsutus* L. = *L. hirsutus*, *O. niger* L. = *L. niger*, *O. pratensis* Stokes = *L. pratensis*; *O. sylvaticus* Baumg. (*O. vernus* L.) = *L. vernus*; *O. tuberosus* L. = *L. montanus*.

**Orontium** Linn. Araceae (III). 1 sp. Atlantic N. Am.

**Oryza** Linn. Gramineae (VI). 6 sp. trop., the most important of which is *O. sativa* L., the rice plant, the chief food plant of the world. It is an annual about 1—6 feet high. The common rice is cultivated in hot steamy lowlands, and the fields are covered with water; the mountain form is cultivated up to 6000 feet without irrigation. The grain in the husk is known as paddy.

**Osbeckia** Linn. Melastomaceae (I). 50 sp. Old World trop.

**Osmanthus** Lour. Oleaceae (I. 3). 10 sp. E. and S. As., Polynes., N. Am. *O. fragrans* Lour. (*Olea fragrans* Thunb.) is often cultivated in hot-houses; it has an edible fruit, and its leaves are used to perfume tea.

**Osmunda** Linn. Osmundaceae. 6 sp. temp. and trop. *O. regalis* L., the royal fern, is found in Brit. It has a root-stock bearing scale leaves below the soil and ordinary leaves above. The stock may sometimes be found a foot high, like the stem of a tree fern. The fronds are large (1—10 feet); the lower pinnae are vegetative, the upper are reproductive only and form a sort of panicle. They are densely covered with sori, which have no indusium and have a peculiar annulus consisting of a round group of cells at one side of the apex. The sporangium dehisces longitudinally. Other sp. have the fertile pinnae on the lower part of the leaf, others again have separate vegetative and reproductive leaves.

**Osmundaceae**. Filicineae Leptosporangiatæ (Homosporous). 2 gen. with 10 sp. trop. and temp. Short-stemmed ferns, with naked sori. The sporangia are shortly stalked and have an annulus, consisting of a roundish group of cells at one side of the apex; they open by a longitudinal fissure. *Genera*: *Osmunda* (sori on special pinnae), *Todea* (sori on backs of ordinary pinnae).

**Osteomeles** Lindl. Rosaceae (II. 4). 10 sp. Andes, Sandwich Is., &c.

**Osteospermum** Linn. Compositae (IX). 38 sp. S. Afr.

**Ostrowakia** Regel. Campanulaceae (I. 1). 1 sp. Turkestan.

**Ostrya** Mich. ex Linn. Betulaceae. 2 sp. N. temp. Like *Carpinus*.

*O. virginica* Willd. (lever-wood) furnishes a hard wood.

**Othonna** Linn. Compositae (VIII). 80 sp. S. Afr. Xerophytes (p. 178) with swollen roots and often fleshy leaves.

**Ouratea** Aubl. = *Gomphia* Schreb.

**Ourisia** Comm. ex Juss. Scrophulariaceae (III. 10). 19 sp. S. temp.

**Ourouparia** Aubl. = *Uncaria* Schreb.

**Ouvirandra** Thou. = *Aponogeton* Thunb.

**Oxalidaceae.** Dicotyledons (Archichl. Geraniales). 7 gen. with 250 sp. mostly trop. and subtrop. Most are perennial herbs with alt. often compound exstip. leaves and large flrs., usually in cymes. Flr. ♂, regular. K 5, imbricate, persistent; C 5, twisted or imbricate, free or slightly united; A 10, obdiplostemonous (i.e. the outer whorl opp. to the petals, the inner to the sepals, and thus the cpls. opp. to the petals, instead of to the sepals, as in diplostemonous flrs. with two whorls of sta. in proper alternation), united below, with introrse anthers; G (5), with free styles, 5-loc., with axile placentae; ovules in 1 or 2 rows in each loc., or few, anatropous, with micropyle facing upwards and outwards. Fruit a capsule or berry; embryo straight, in fleshy endosperm. *Chief genera:* *Oxalis*, *Biophytum*, *Averrhoa*. The order is closely allied to Geraniaceae, to which it is united by Benth.-Hooker. The chief difference is in the fruit. Warming places it in Gruinales.

**Oxalis** Linn. Oxalidaceae. 220 sp. cosmop. chiefly S. Afr., Am. *O. Acetosella* L. (wood-sorrel) in Brit. It is a small herb with monopodial rhizome and ternate leaves, which sleep at night and in cold weather, the leaflets bending downwards. The flr. is protandrous; the stalk bends downwards and the flr. closes in dull or cold weather. Cleistogamic flrs. (cf. *Viola*, and see p. 92) occur, sometimes, it is said, below ground. The fruit is a loculicidal capsule. The seed has a fleshy aril springing from the base. When ripe the cells of the inner layers are extremely turgid, and a small disturbance causes the aril to turn inside out, as one might turn a glove-finger, from U to n. This is done instantaneously and the seed is shot off to some distance.



Many sp. have bulbous or tuberous stems. Some, e.g. *O. bupleurifolia* A. St. Hil. have phyllodes in place of the ordinary leaves (cf. *Acacia*). The flrs. are solitary or in cymose infls. Many sp. exhibit trimorphic heterostyled flrs. (see Darwin *Forms of Flrs.*); there are three stocks of plants, one bearing flrs. with long styles, and mid- and short-length sta., the others with mid or short styles and correspondingly long and short or long and mid sta. (cf. *Lythrum*). Some sp. produce axillary bulbils: others reproduce vegetatively by underground offshoots. [See Hildebrand's *Lebensverhältnisse d. O.-arten*, Jena, 1884.] The tubers of *O. Deppei* Lodd. (S. Am., Mex.), and others, are used as food.



**Oxera** Labill. Verbenaceae (IV). 12 sp. New Caled.

**Oxybaphus** L'Hérit. Nyctaginaceae. 12 sp. W. Am., Himal. United to *Mirabilis* in *Nat. Pfl.*

**Oxycoccus** Tourn. ex Adans. = *Vaccinium* Linn. *O. palustris* Pers. = *V. Oxycoccus*.

- Oxygraphis** Bunge. Ranunculaceae (3). 9 sp. N. temp.
- Oxylobium** Andr. (*Callistachys* Vent.). Leguminosae (III. 2). 27 sp. Austr.
- Oxymitra** Hook. f. et Thoms. Anonaceae (4). 50 sp. Old World trop.
- Oxypetalum** R. Br. Asclepiadaceae (II. 2). 80 sp. Brazil, Mexico, W. Indies.
- Oxyria** Hill. Polygonaceae (1. 2). *O. digyna* Hill, the only sp., in N. Arctic and subarctic regions (in Brit. an alpine plant). Like *Rumex*, but dimerous, and with 'dédoublement' of the outer sta.
- Oxytropis** DC. Leguminosae (III. 6). 150 sp. N. temp.; 2 in Brit.
- Pachira** Aubl. Bombacaceae. 4 sp. trop. Am. United to *Bombax* in *Nat. Pl.*
- Pachyrhizus** Rich. Leguminosae (III. 10). 2 sp. trop. Am., As., largely cultivated for the edible tuberous root (Yam-bean).
- Pachysandra** Michx. Buxaceae. 2 sp. Japan, Alleghanies (cf. *Epigaea*).
- Padus** Linn. = *Prunus* Tourn.
- Paederota** Linn. Scrophulariaceae (III. 10). 2 sp. Mts. of Eur. (p. 159).
- Paeonia** (Tourn.) Linn. Ranunculaceae (1). 15 sp. Eur., As., west N. Am. *P. officinalis* L. is the common Paeony, noteworthy for its tuberous roots, large flrs. with great secretion of honey, slight cohesion of cpls., and follicle with red seeds. The protogynous flrs. close at night.
- Paepalanthus** Mart. Eriocaulaceae. 215 sp. S. Am., 1 N. Am., 1 S. Afr.
- Palafoxia** Lag. Compositae (vi). 7 sp. U.S.
- Palaquium** Blanco (*Dichopsis* Thw.). Sapotaceae (1). 50 sp. Indomal. *P. Gutta* Burck was formerly the chief source of gutta-percha, but it is now quite extinct except in cultivation, and the commercial article is obtained from other sp. and from *Payena Leerii*, &c. The trees are cut down or ringed and the milky latex coagulates, forming gutta percha (cf. caoutchouc).
- Palava** Juss. (*Palaua* Cav.). Malvaceae (1). 3 sp. Chili, Peru.
- Palicourea** Aubl. Rubiaceae (II. 15). 100 sp. trop. Am.
- Palisota** Rchb. Commelinaceae. 8 sp. trop. W. Afr.
- Paliurus** Tourn. ex Mill. Rhamnaceae. 2 sp., one, *P. aculeatus* Lam. (Christ's thorn, cf. *Zizyphus*), S. Eur. to China, the other, *P. ramossissimus* Poir. in China and Japan. The former has stipular thorns, one straight, the other recurved; the latter has both thorns straight. The fruit has a horizontal wing, developed at the base of the style after fertilisation.
- Palmae**. Monocotyledons (Principes). 128 gen. with 1100 sp. trop. and subtrop.; most of the genera are well localised in the various floral regions, the chief exceptions being *Cocos nucifera*, *Elaeis guineensis* and *Raphia vinifera*. The palms form a characteristic feature of the vegetation of the tropics (pp. 165, 199). The vegetative habit

is familiar—a crown of leaves at the end of an unbranched stem (Hyphaene is branched). The stem exhibits various forms; some palms, *e.g.* Nipa, Phytelephas, have a short stock bearing ‘radical’ leaves; some, *e.g.* Geonoma, Calamus, Desmoncus, have a thin reed-like stem with long internodes (the two latter genera are climbers); others again have a tall stem with a crown of leaves at the top. The stem is often covered with the remains of old leaf-sheaths, or is thorny. Its height reaches 150 feet in some sp., and it grows slowly in thickness, by a method which requires investigation. At the base the stem is usually conically thickened or else provided with buttress roots; this gives the necessary mechanical rigidity and is a consequence of the fact that the stem does not curve in a gale but bends from the base, from a position like  to one like . The stems of Cocos and other palms are curved instead of straight; the meaning of this is unknown.

The leaf is very characteristic; the only closely similar leaf is that of Carludovica, though those of Cycads and some tree ferns have a superficial likeness to palm-leaves. Some genera have palmate (fan) leaves, some pinnate (feather) leaves, but this structure arises by a development unlike that which gives rise to these forms in Dicotyledons and more like that which occurs in Araceae (see *Nat. Pfl.*). The leaf is usually very large, and at the base of the petiole is a sheath, which makes a firmer attachment to the stem than a mere articulation. The sheath contains many bundles of fibres, which remain after the decay of the softer tissues. The pinnae are folded where they meet the main stalk of the leaf, sometimes upwards (*induplicate*,  in section), sometimes downwards (*reduplicate*,  in section); these characters are important in classification. The leaf emerges from the bud in an almost vertical line and thus, placing its apex to the sky, escapes excessive radiation and transpiration. The palms are pronounced sun-plants (p. 152), and show xerophytic characters in their leaves. The leaf-surface is glossy with a thick cuticle, and is rarely arranged perpendicularly to the incident rays. Often the leaf is corrugated, or placed at an angle by the twisting of the stalk or by the upward slope of the stalk; sometimes the leaflets slope upwards, and so on.

The infl. is usually very large and much branched. In Corypha and others it is terminal, its production being a mark of the end of the life of the plant (cf. Agave), but usually it is axillary; sometimes the infls. are in the axils of the current leaves, sometimes lower on the stem. The branching is racemose and the flrs. are often embedded in the axis, so that the whole is often termed a spadix. It is enclosed in a spathe of several leaves and emerges from it when the flrs. are ready to open. Some Palms are dioecious, some monoecious, in the latter case often with the flrs. in groups (small dichasia) of 3, one ♀ between two ♂.



The flr. has usually the formula  $P\ 3+3$ ,  $A\ 3+3$ ,  $\underline{G}\ 3$  or (3). The perianth has both whorls alike and varies in texture. The cpls. when united may form a 1-loc. or 3-loc. ovary, with 3 or sometimes 1, anatropous ovules (rarely semi-anatropous, or orthotropous). The pollination-methods of the Palms want investigation; some, e.g. Cocos, are wind-pollinated, others are doubtless entomophilous.

The fruit is a berry or drupe; in the latter case the endocarp is usually united to the seed. The fruit in *Lepidocaryinae* is covered with dry woody scales. The seed has a large endosperm; in date, vegetable ivory &c. it is very hard, the non-nitrogenous storage-material taking the form of cellulose, which is deposited upon the cell walls. In germination the cotyledon lengthens and pushes out the radicle, and then the plumule grows out of the sheathing cotyledon (see *Nat. Pfl.*).

Economically, the P. are very important, furnishing many of the necessities of life in the tropics &c. Many have edible fruit or seed, e.g. date (Phoenix) and coco-nut (Cocos); the stems contain much starch as reserve food, especially in those sp. which save up for a great terminal infl., e.g. Metroxylon (sago), Caryota, &c.; the rush of sap to the infl., especially in the cases just mentioned, is great; and by tapping the stem great quantities of sugar-containing fluid may be obtained and utilised, either directly as a source of sugar or indirectly to make intoxicating drinks by fermentation. The bud of leaves at the top of the stem is often used as cabbage. The stems are used in building, but do not yield plank-timber; the leaves are used in thatching and basket-making, and for hats, mats, &c.; the fibres of the leaf-sheaths are used for ropes &c.; other P. furnish oil (e.g. Elaeis, Cocos), wax (Copernicia), vegetable ivory (Phytelephas, &c.), betel-nuts (Areca), &c.

*Classification and chief genera* (after Drude):

A. Perianth 6-partite, enclosing the fruit after fertilisation.

I. *CORYPHINAE* (spadix loosely branched, often a prolix panicle; flrs. single or in long rows flowering from above; cpls. 3, or loosely united, separating after fertilisation; berry; fan or feather leaves, induplicate):

1. *Phoenixaceae*: Phoenix.

2. *Sabaleae*: Chamaerops, Rhaps, Corypha, Livistona, Sabal, Copernicia.

II. *BORASSINAE* (spadix simple or little branched with thick cylindrical twigs; flrs. markedly declinuous dimorphic, invested with bracts, the ♂ in 1—∞ cincinni in grooves of the twigs; cpls. (3), fully united, producing a one-seeded drupe; fan leaves, induplicate):

3. *Borasseae*: Borassus, Lodoicea.

III. *LEPIDOCARYINAE* (spadix branched once or more in a 2-ranked arrangement; flrs. in cincinni or 2-ranked

spikes with bracts and bracteoles round them; cpls. (3), fast united, covered with scales; fruit 1-seeded, covered with hard scales; feather or fan leaves, reduplicate):

4. *Mauriticeae*: Mauritia.

5. *Metroxyleae*: Raphia, Metroxylon, Calamus.

IV. *CEROXYLINAE* (spadix simple or one or several times branched; flrs. diclinous, usually dimorphic; when dioecious, solitary with rudimentary bracts, when monœcious usually in cymes of 3 flrs., 2 being ♂ and 1 ♀, or rarely ∞ ♂ and 1 at the end of the row being ♀; cpls. (3), 3-2-1-loc.: fruit smooth, not scaly; feather leaves):

6. *Arecineae*: Caryota, Arenga, Leopoldinia, Iriartea, Ceroxylon, Chamaedorea, Oreodoxa, Euterpe, Areca.

7. *Coccineae*: Elaeis, Attalea, Cocos, Bactris, Desmoncus.

B. Perianth rudimentary in ♂ or ♀. Fruits in dense heads.

V. *PHYTELEPHANTINAE*: Phytelephas, Nipa (only genera).

[Placed in Calycinae by Benth.-Hooker, in Spadiciflorae by Warming.]

For further details of P. see *Nat. Pfl.*, Haberlandt's *Tropenreise*, pp. 62 seq., Seemann's *History of the Palms*, and *Treas. of Bot.*

**Panax** Linn. (incl. *Cheirodendron* Nutt., *Nothopanax* Seem.). Araliaceae. 30 sp. As., Afr., Polynes., Austr., N.Z.

**Pancratiun** Dill. ex Linn. Amaryllidaceae (1). 12 sp. Medit., trop. As.

**Pandanaceae**. Monocotyledons (Pandanales). 2 gen. with 80 sp., characteristic plants of the Old World tropics (p. 203). They are mostly sea-coast or marsh plants with tall stems supported upon flying-buttress roots, and frequently branched; some are climbers. The aerial roots have marked root-caps of membranous texture. The leaves are in 3-ranked phyllotaxy, but the stem is usually twisted so that the leaves form well-marked spirals (whence the name screw-pine). The leaf is parallel-veined, long and narrow, with an open sheath and usually thorny margin; it is generally sharply bent downwards at the middle, and is corrugated like a palm leaf. The infl. is usually a racemose spadix with neither bracts nor bracteoles, and it is difficult to make out the individual flrs. The ♂ flrs. in sp. of Freycinetia have a rudimentary gynœceum, in the rest of the order they have not. The floral axis bears a number of sta., arranged in a raceme- or umbel-like manner upon it. The gynœcium in the ♀ flr. consists of ∞ cpls. in a ring, 1-loc. in Freycinetia, multi-loc. in Pandanus, the union being more or less complete, or it may be reduced, even to 1 cpl., or to a row of cpls. arranged transversely. Stigmas sessile. Ovules anatropous. Fruit a berry in Freycinetia, a multiloc. drupe in Pandanus. Both genera yield useful products. *Genera*: Freycinetia, Pandanus. Placed in Nudiflorae by Benth.-Hooker, in Spadiciflorae by Warming.

**Pandanales**. The 1st cohort of Monocotyledons (p. 134).

**Pandaneae** (Benth.-Hooker) = Pandanaceae.

**Pandanus** Rumph. ex Linn. f. Pandanaceae. 50 sp. trop. As. and Afr. (the screw-pines). Trees with flying-buttress roots. The fls. are in large heads, enclosed in spathes. The  $\sigma$  consists of  $\infty$  sta., arranged in various ways upon the axis, the  $\varphi$  of 1— $\infty$  cpls., free or united. Each gives a drupe containing as many seeds as there were cpls. Seeds albuminous. The pericarp is rich in fibres. The fruits of some sp. are cooked and eaten; the leaves are used for weaving.

**Panicum** Linn. Gramineae (v). 300 sp. trop. and warm temp. The spikelets are 1- or 2-flowered. *P. miliaceum* L. is the Indian millet, *P. frumentaceum* Roxb. the Samoa millet, both important cereals. *P. maximum* Jacq. (Guinea grass) and others are important fodder plants. Many of these are distributed by the animals feeding upon them, for the joints of the stem will grow after passing through the alimentary canal.

**Papaver** Tourn. ex Linn. Papaveraceae (II). 40 sp. Eur., As., S. Afr., Austr. *P. Rhoeas* L. and 3 others (poppy) in Brit. The fls. nod in bud, not by their own weight, but by more rapid growth of one side of the stalk. The ovary is crowned by a sessile rayed stigma, each lobe of which stands over a placenta instead of as usual over a midrib. This is commonly explained by supposing each actual ray of the stigma to be formed of one half of each of two adjacent stigmas. The flr. of most sp. contains no honey, and is homogamous; both cross- and self-pollination usually occur with insect visits. The fruit is a round capsule, opening by pores under the eaves of the roof formed by the dry stigmas, so that the seeds are well protected from rain and can only escape when the capsule is shaken by strong winds or other agencies. *P. somniferum* L. is the opium poppy; the drug is obtained by cutting notches in the half ripened capsules, from which the latex exudes and hardens. The seeds of this and other sp. yield an oil on pressure.

**Papaveraceae.** Dicotyledons (Archichl. Rhoeadales). 28 gen. with 210



Floral diagram of *Corydalis cava* (after Eichler).

sp., chiefly N. temp. Most are herbs with alt. leaves, and sub-orders I. and II. contain latex. *Corydalis* and *Fumaria* are climbers, *Bocconia* a small shrub. The fls. are solitary or in racemes, or in dichasia with cincinnal tendency, regular or irregular,  $\varphi$ , hypogynous (exc. *Eschscholtzia*).  $K_2$  (united in *Eschscholtzia*), caducous;  $C_2 + 2$ , rolled or crumpled in bud (see *Hypecoum*);  $A_4$  or  $\infty$  or 2 (see sub-orders); in the last case each sta. branches into 3 parts (see fig.), the centre one bearing an entire anther, the lateral ones each half an anther;

**G** (2—8), 1-loc. with parietal placentae, which in *Papaver*, &c. project into the loc. Ovules generally  $\infty$ , anatropous or slightly campylotropous. Fruit a septicidal capsule, or one opening by pores, or a nut; seeds with oily endosperm, and small embryo. The flrs. are mostly large and conspicuous, but many contain no honey and are visited by pollen-seeking insects; they are often protandrous. Those of sub-order III. are irregular, and adapted to bees in a way somewhat like that found in Leguminosae. The order is of little economic value; see *Papaver*.

*Classification and chief genera:*

- I. **HYPECOIDEAE** (petals without spur; sta. 4; cpls. 2):  
Hypocum.
- II. **PAPAVEROIDEAE** (as I., but sta.  $\infty$ ; cpls. 2— $\infty$ ):  
Eschscholtzia, Chelidonium, Glaucium, Papaver.
- III. **FUMARIOIDEAE** (petals with spur; sta. 2, each branched into 3): Dicentra, Corydalis, Fumaria.

Many authors, e.g. Warming, split off III. as a separate order, Fumariaceae. Benth.-Hooker place P. in Parietales; Warming places it in Rhoeadinae.

**Papayaceae** (Warming) = Caricaceae.

**Pappea** Eckl. et Zeyh. Sapindaceae (1). 2 sp. trop. and S. Afr. *P. capensis* E. et Z. is the 'Wilde Preume' of S. Afr., with an edible fruit; oil is obtained from the seeds, and the timber is useful.

**Papyrus** Willd. = Cyperus Mich. *P. antiquorum* Willd. = *C. Papyrus*.

**Paracaryum** Boiss. Boraginaceae (IV. 1). 35 sp. Medit. Orient.

**Paradisia** Mazzuc. Liliaceae (III). 1 sp. Mts. of Eur. (p. 159).  
*P. Lihastrum* Bertol. The flr. is adapted to nocturnal moths.

**Paramignya** Wight. Rutaceae (x). 6 sp. Indo-mal.

**Parietales**. The 19th cohort (Engler) of Archichlamydeae (p. 138).  
The 2nd cohort (Benth.-Hooker) of Polypetalae (p. 141).

**Parietaria** (Tourn.) Linn. Urticaceae. 7 sp. temp. (*P. officinalis* L., pellitory, in Brit.). The flrs. are mostly  $\varnothing$  (unlike most of the order), and stand in little cymes in the leaf axils. According to Eichler the first flr. is  $\varnothing$ , the bulk of the cyme  $\varnothing$ , and the last flrs.  $\sigma$ . The  $\varnothing$  flrs. are exceedingly protogynous, the style protruding from the bud; the sta. develop later, exploding when ripe like those of the nettle, but by this time the stigma is incapable of fertilisation, and usually the style has dropped off altogether, so that at first glance the flr. looks as if it were male.

**Paris** (Rupp.) Linn. Liliaceae (VII). 6 sp. temp., Old World. *P. quadrifolia* L. (herb-Paris) in Brit. There is a monopodial rhizome and an aerial stem with a whorl of 4 or more net-veined leaves; the aerial stems are formed, not annually, but at irregular periods. Perianth 4- (or more) merous, as well as the other whorls; in herb-Paris the sepals alternate with the foliage-leaves. The flrs. of this sp. are very protogynous, and their colours and scent attract flies.

- Parkia** R. Br. Leguminosae (1. 6). 19 sp. trop. The flrs. are in heads, of which either the upper or lower flrs. are male or neuter.
- Parnassia** (Tourn.) Linn. Saxifragaceae (1). 19 sp. N. temp., chiefly in mountain bogs; 1 in Brit.—*P. palustris* L. (grass of Parnassus). The floral axis is hollowed out and united to the base of the ovary. K-5; C 5; A 5, and alternating with them 5 staminodes; G (4) or half-inferior, 1-loc., with large projecting parietal placentae. The flr. is protandrous, the anthers in turn dehiscing just above the pistil and then moving outwards. The staminodes are opposite to the petals. Each has a solid nectar-secreting base, and ends above in a candelabra-like structure, each twig of which is terminated by a yellow knob, glistening in the sun and looking like a drop of honey. Flies are deceived by this appearance, and have been seen licking the knobs. [See Eichler's *Bluthendiag.*]
- Parochetus** Buch.-Ham. Leguminosae (III. 4). 1 sp. Mts. of trop. As. and Afr. It has cleistogamic and open flrs.
- Paronychia** (Tourn.) Linn. Caryophyllaceae (II. 4). 40 sp. temp. and sub-trop. The small axillary flrs. are concealed by the stipules. In *P. Kapela* A. Kern. the head of fruits breaks off as a whole and is rolled about by the wind.
- Paronychiaceae.** See Caryophyllaceae (II. 4).
- Parrotia** C. A. Mey. Hamamelidaceae. 1 sp. Persia, *P. persica* C. A. Mey. Flrs. ♀, apetalous.
- Parsonsia** R. Br. Apocynaceae (II. 5). 10 sp. Malaya, Austr., Polynes., N.Z.
- Parthenium** Linn. Compositae (v). 9 sp. N. Am., W. Ind.
- Pasania** Oerst. = *Quercus* Tourn.
- Paspalum** Linn. Gramineae (v). 160 sp. trop., also in temp. Am., where they form a large proportion of the pasture of the Campos, Pampas, &c. Good fodder grasses.
- Passerina** Linn. Thymelaeaceae. 4 sp. Cape Colony.
- Passiflora** Linn. (excl. *Tacsonia* Juss.). Passifloraceae. 250 sp. chiefly Am.; a few in As. and Austr., 1 in Madag. They are climbing plants with axillary tendrils. Some sp. have curious bilobed leaves (crescentic or swallow-tailed in shape), the centre lobe not developing. At the base of the leaf-stalk there are usually extra-floral nectaries. The flrs. spring from the same leaf-axils as the tendrils, solitary or in small cymes; the bract is usually 'adnate' to the peduncle. The receptacle is hollowed into a cup, bearing on its margin 5 sepals, 5 petals, and a number of effigurations of the axis—thread-like petaloid bodies, forming a dense mass (the corona) round the central androphore, at whose apex is borne the ovary. Five sta. spring from the androphore at the base of the ovary, and are bent downwards at first; afterwards the styles bend down also. Honey is secreted at the base of the androphore. The fruit is a berry; the seed is enveloped in a fleshy aril. Many passion-flowers are cultivated as

ornamental plants. Several have edible fruit, *e.g.* *P. quadrangularis* L., the Granadilla (trop. Am.), *P. maliformis* L., the sweet calabash (W. Ind.), *P. laurifolia* L., the water-lemon, &c.

**Passifloraceae.** Dicotyledons (Archichl. Parietales). 18 gen. with 280 sp. trop. and warm temp. Shrubs and herbs, mostly climbers with axillary tendrils, and with alt. stip. leaves. Flrs. ♀ or unisexual, regular. Receptacle of various shapes, often hollowed and frequently with a central andro- or gyno-phore; it is usually terminated by out-growths, often of petaloid or staminodial appearance, forming the *corona*. K 3—5; C 3—5 or 0; A 3—5;  $\bar{G}$  (3), 1-loc. with parietal placentae and several or  $\infty$  anatropous ovules; style 1, simple or branched, or 3—5 separate styles. Capsule or berry. Seed with fleshy aril and endosperm. *Chief genera:* Modecca, Passiflora. Benth.-Hooker include Caricaceae and Malesherbiaceae in P. and place the order in Passiflorales; Warming excludes Caricaceae and places P. in Passiflorinae.

**Passiflorales** (Benth.-Hooker). The 13th cohort of Polypetalae (p. 143).

**Passiflorinae** (Warming). The 21st cohort of Choripetalae (p. 146).

**Pastinaca** Linn. = Peucedanum Tourn. *P. sativa* L. = *Peuced. sativum*.

**Patagonium** Schrank = Adesmia DC.

**Patrinia** Juss. Valerianaceae. 13 sp. E. As.

**Paullinia** Linn. Sapindaceae (1). 120 sp. trop. and sub-trop. Am., 1 in Madag. and Afr. Lianes with watch-spring tendrils (p. 177). Fruit a capsule, often winged.

**Paulowilhelmia** Hochst. Acanthaceae (1v. A). The seeds of some sp. have curious toothed scales, which spread out when wetted and thus anchor the seed (cf. Linum).

**Paulownia** Sieb. et Zucc. Scrophulariaceae (II. 6). 1 sp. Japan, *P. imperialis* Sieb. et Zucc., the only tree in this order. Often grown in parks.

**Pavetta** Linn. Rubiaceae (II. 14). 70 sp. Old World trop.

**Pavia** Boerh. = Aesculus Linn.

**Pavonia** Cav. Malvaceae (III). 70 sp. trop. and sub-trop. There are 5 cpls. and 10 styles, 5 of these corresponding to cpls. which abort in development. The cpls. are hooked in fruit.

**Pavonia** Ruiz et Pav. = Laurelia Juss.

**Payena** A. DC. Sapotaceae (1). 16 sp. Malaya. *P. Leerii* Kurz yields a good gutta percha (see Palaquium), known as Gutta Sundek.

**Pectis** Linn. Compositae (VI). 50 sp. Arizona to Brazil.

**Pedaliaceae.** Dicotyledons (Sympet. Tubiflorae). 14 gen. with 45 sp. trop. and S. Afr., Madag., Indo-mal., mostly shore and desert plants. Herbs or rarely shrubs with opp. leaves and glandular hairs. Flrs. solitary or in cymes (usually 3-flowered), with glands (metamorphosed flrs.) at the base of the stalks, ♀, zygomorphic. K (5); C (5); A 4, didynamous, with a posterior staminode;  $\bar{G}$  (2) [ $\bar{G}$  in Trapella], with

long style and 2 stigmas, 2—4-loc. or apparently 1-loc., often with false septa; ovules 1— $\infty$  per loc., on axile placentae. Capsule or nut, often with hooks. Embryo straight; endosperm thin. Sesame is economically important. *Chief genera*: *Pedaliium*, *Sesamum*, *Harpagophytum*. Benth.-Hooker and Warming unite *Martyniaceae* to *P.*, placing it in *Personales* and *Personatae* respectively. The chief distinctions from *M.* lie in the placentation, the fruit, calyx, and glandular hairs.

**Pedaliineae** (Benth.-Hooker) = *Pedaliaceae*.

**Pedaliium** Royen ex Linn. *Pedaliaceae*. 1 sp. trop. Afr. and As.

**Pedicellaria** Schrank = *Gynandropsis* DC.

**Pedicularis** (Tourn.) Linn. *Scrophulariaceae* (III. 12). 250 sp. N. Hemisph. and S. Am., especially on Mts.; 2 in Brit., *P. palustris* L. and *P. sylvatica* L. (louse-wort), in marshes and moist places. Semi-parasites with loose-pollen flrs., fertilised by humble-bees &c. In a few places in the Arctic regions, *P.* extends beyond the limit of humble-bees (*Bombus*) and the flr. has a shorter tube, adapting it to flies.

**Pedilanthus** Neck. *Euphorbiaceae* (A. II. 8). 15 sp. trop. Am.

**Peganum** Linn. *Zygophyllaceae*. 4 sp. *Medit.*, *As.*, *N. Am.* The seeds of *P. Harmala* L. yield turkey-red. [*Rutaceae*, B. & H.]

**Peireskia** Steud. = *Pereskia* Plum.

**Pelargonium** L'Hérit. *Geraniaceae*. 175 sp., chiefly *S. Afr.*, a few *Medit.*, *Austr.* Many varieties are cultivated as ornamental plants, of which one is the so-called *Geranium* of greenhouses, &c. In many sp. the base of the stem is tuberous. An oil, used as a substitute for attar of roses, is distilled in *Algeria* from *P. odoratissimum* Ait.

**Pellaea** Link. *Polypodiaceae*. 45 sp. trop. and sub trop.

**Pellionia** Gaudich. *Urticaceae*. 15 sp. trop. *As.*, *Polynes.* Like *Urtica*. *P. umbellata* Wedd. has the bracts of the  $\delta$  flrs. united to form an involucre.

**Penaea** Linn. *Penaeaceae*. 10 sp. Cape Colony.

**Penaeaceae**. Dicotyledons (Archichl. Thymelaeales). 5 gen. with 22 sp. *S.W. Cape Col.* Shrubby xerophytes of ericoid habit, with opposite evergreen leaves. Flowers axillary, solitary or in pairs, the bracts often coloured. Flr.  $\wp$ , regular, 4-merous. Receptacle hollow, tubular. No petals. Ovary 4-loc.; style simple. Ovules 2 in each loc., anatropous. Capsule. No endosperm. *Chief genera*: *Penaea*, *Sarcocolla*. Placed in *Daphnales* by Benth.-Hooker.

**Pennisetum** Rich. *Gramineae* (v). 40 sp. trop. and sub trop *Afr.*, *S. Eur.*, *As.*, *Am.* Involucre as in *Cenchrus*. *P. typhoideum* Rich., the pearl millet, is an important cereal in *India*.

**Pentadesma** Sabine. *Guttiferae* (vi). 1 sp., *P. butyracea* Sabine, the tallow or butter tree, in *Sierra Leone*. The fruit yields a greasy juice used as butter.

**Pentapterygium** Klotzsch. *Ericaceae* (III. 8). 5 sp. *E. Himal.* to *Khasia*. Fruit a five-winged berry.

- Pentas** Benth. Rubiaceae (I. 2). 10 sp. trop. and subtrop. Afr., Madag.
- Pentstemon** Mitch. Scrophulariaceae (II. 6). 80 sp. N. Am., E. As. Several sp. are cultivated. The posterior sta. is represented by a large staminode which is bent down and lies upon the lower side of the corolla, out of the way of insect-visitors (cf. Scrophularia).
- Peperomia** Ruiz et Pav. Piperaceae. 400 spec. trop., esp. Am. Many are epiphytes with creeping stems, adventitious roots and fleshy leaves (water-tissue under the upper epidermis, see pp. 182, 186). Flrs. ♂, with 2 sta., arranged in terminal spikes, which may, as in Piper, give rise to a sympodium.
- Peplis** Linn. Lythraceae. 3 sp. wet places, N. temp. *P. Portula* L. occurs in Brit. It is a little annual herb, very like *Montia fontana* with minute hexamerous flrs. Self-fertilisation occurs by the bending inwards of the sta. over the stigma. The fruit is bilocular (the partition does not come up to the very apex) with many seeds, but indehiscent. When submerged the plant has a more etiolated structure and becomes perennial.
- Pereskia** Plum. ex Linn. Cactaceae (III). 13 sp. trop. Am., W. Ind. Leafy plants (see order). Some, e.g. *P. aculeata* Mill., climb like Rubus with recurved thorns.
- Perezia** Lag. Compositae (XII). 70 sp. Texas to Patagonia.
- Perilla** Linn. Labiatae (VI. 11). 2 sp. E. Ind., China.
- Perilomia** H. B. et K. Labiatae (VI. 2). 8 sp. Andes.
- Periploca** Tourn. ex Linn. Asclepiadaceae (I. 1). 12 sp. As., Afr., S. Eur.
- Peristeria** Hook. Orchidaceae (19). 5 sp. Cent. Am. Epiphytic. *P. elata* Hook. ('el spirito santo,' so called by the natives of Panama because of its resemblance to a dove) is best known. Its mechanism requires investigation.
- Pernettya** Gaudich. Ericaceae (II. 5). 26 sp., one Tasmania and N. Z., the rest S. Am. and Mexico.
- Persea** Plum. ex Linn. Lauraceae (I). 10 sp. trop. Am. The fruit of *P. gratissima* Gaertn. f., and other sp., is eaten under the name Avocada or alligator pear.
- Persicaria** (Tourn.) Linn. = Polygonum Tourn.
- Personales** (Benth.-Hooker). The 9th cohort of Gamopetalae (p. 144).
- Personatae** (Warming). The 5th cohort of Sympetalae (p. 146).
- Persoonia** Sm. Proteaceae (I). 60 sp. Austr., N. Z.
- Pescatorea** Rchb. f. = Zygotepalum Hook.
- Petalostemon** Michx. (*Kuhnistera* Lam.) Leguminosae (III. 6). 20 sp. N. Am.
- Petasites** (Tourn.) Linn. Compositae (VIII). 14 sp. N. temp. *P. officinalis* Moench, the butter-bur, is common in Brit. on the banks of streams &c. It spreads very largely by rhizomes. It is dioecious (cf. Tussilago, its close ally). The male head has about 30 flrs. with



the usual mechanism of Compositae, the style acting as the pollen-presenter, though the ovary is no longer fertile. Occasionally a few ♂ flrs. are found. The female head consists of about 150 ♀ flrs. surrounding 1—3 ♂ flrs. Only the male flrs. secrete honey. Under the name of winter heliotrope, *P. fragrans* Presl is cultivated for its scented flrs., which appear in February.

**Petrea** Houst. ex Linn. Verbenaceae (II). 12 sp. trop. Am., W. Ind.

**Petrophila** R. Br. Proteaceae (I). 35 sp. Austr.

**Petrophyes** Webb et Berth. = *Monanthes* Haw.

**Petroselinum** Hoffm. = *Carum* Linn.

**Petunia** Juss. Solanaceae (IV). 14 sp. S. Am. *P. violacea* Lindl. and others are often cultivated in gardens.

**Peucedanum** (Tourn.) Linn. (incl. *Anethum* Tourn., *Imperatoria* Linn. *Pastinaca* Linn.). Umbelliferae (7). 120 sp. Eur., As., Afr., Am.; 4 in Brit., of which *P. (Past.) sativum* Benth. et Hook. f. is the parsnip, often cultivated for its fleshy roots. *P. (A) graveolens* Benth. et Hook. f. (Medit.) is the dill, whose fruits are used as a condiment; *P. officinale* L. (Brit.) is the sulphur-root, used in veterinary practice; *P. (I.) Ostruthium* Koch (Brit.) is also used.

**Peumus** Molina. Monimiaceae. 1 sp. Chili, *P. Boldus* Molina, the Boldo. The wood is hard, the bark yields a dye and the fruit is edible.

**Phaca** Linn. = *Astragalus* Linn.

**Phacelia** Juss. (incl. *Cosmanthus* Nolte, *Eutoca* R.Br., *Whitlavia* Harv.). Hydrophyllaceae. 80 sp. N. Am., Andes. Often cultivated as border plants and for bee-feeding. The flr. is a bee-flower with honey secreted below the ovary and guarded by stipule-like flaps at the base of the sta. The large-flowered sp. are highly protandrous, and are not self-fertilised; the smaller less protandrous and with self-fertilisation. The anther as it dehisces turns inside out, and changes its shape from ellipsoidal to spherical (*Linn. Soc. Journ.*, 1893, p. 53).

**Phaedranassa** Herb. Amaryllidaceae (I). 4 sp. S. Am.

**Phaenocoma** D. Don. Compositae (IV). 1 sp. Cape Colony.

**Phajus** Hassk. Orchidaceae (15). 12 sp. trop. As., Malaya, Austr., &c. Terrestrial plants.

**Phalaenopsis** Blume. Orchidaceae (31). 35 sp. Indo-mal. Epiphytes with flattened aerial roots.

**Phalaris** Linn. Gramineae (VII). 10 sp. Eur., Am. *P. canariensis* L. is the canary grass, whose seeds are used for cage-birds. *P. arundinacea* L. (reed-grass) is common in Brit.

**Pharbitis** Choisy = *Ipomoea* Linn.

**Pharus** P. Br. Gramineae (VI). 5 sp. trop. Am.

**Phaseolus** (Tourn.) Linn. Leguminosae (III. 10). 150 sp. trop. and warm temp. The floral mechanism is like that of *Vicia*, but complicated by the spiral coiling of the keel with the inclosed style. *P.*

- multiflorus* Willd. (Mexico) is the scarlet-runner, *P. vulgaris* L. the French or kidney bean. *P. Mungo* L. (*P. Max* L.) the 'green gram' of India, used like kidney beans.
- Phegopteris** Fée = *Polypodium* Linn. *P. Dryopteris* Fée = *Polyp. Dryopteris*; *P. polypodioides* Fée = *Polyp. Phegopteris*.
- Phelypaea** Tourn. ex Linn. Orobanchaceae. 2 sp. Cent. As.
- Philadelphus** (Riv.) Linn. Saxifragaceae (III). 13 sp. N. temp. &c. Shrubs with opp. leaves; the buds arise closely protected by the leaf-bases through which in many sp. they have to break. The flrs. are conspicuous and strongly scented. Sta. 20—40; ovary inferior, usually 4-loc. Flr. protogynous. Several sp. are grown in shrubberies under the name *Syringa*.
- Philesia** Comm. ex Juss. Liliaceae (x). 1 sp. S. Chili.
- Phillyrea** Linn. Oleaceae (1. 3). 6 sp. Medit.
- Philodendron** Schott. Araceae (v). 120 sp. trop. Am. Most are shrubs, usually climbing and often epiphytic, with both clasping roots and aerial roots reaching the soil (see order). The pinnation of the leaf is due to a delayed development of the portions between the ribs, and not to a process such as occurs in *Monstera* (q.v.). Monoëcious.
- Phylodraceae**. Monocotyledons (Farinosae). 3 gen. with 4 sp. Indo-mal., Austr. See *Nat. Pfl.* Placed in Coronarieae by Benth.-Hooker, in Liliiflorae by Warming.
- Phleum** Linn. Gramineae (VIII). 10 sp. temp. except Austr. *P. pratense* L. the timothy-grass (Brit.) is a valuable fodder.
- Phlomis** Linn. Labiatae (VI. 4). 65 sp. Medit. to China. The upper lip of the flr. is raised by an entering insect.
- Phlox** Linn. Polemoniaceae. 30 sp. N. Am., Siberia. Favourites in horticulture.
- Phoenix** Linn. Palmae (1. 1). 12 sp. trop. Afr., As. The chief is *P. dactylifera* L., the date palm of Afr. and S.W. As. It has a columnar stem covered with old leaf-bases; the leaves are pinnate. Flrs. dioecious; the Arabs fertilise the ♀ spadix by hanging a ♂ over it. Fruit a berry; seeds with hard (cellulose) endosperm. The date-palm yields fruit, wine, sugar, hats, mats, thatch, and many other products.
- Pholidia** R. Br. Myoporaceae. 57 sp. Austr.
- Pholidota** Lindl. Orchidaceae (7). 20 sp. Indo-mal., S. China.
- Phormium** Forst. Liliaceae (III). 2 sp. N.Z. Leaves isobilateral. The leaf of *P. tenax* Forst. furnishes the valuable fibre called New Zealand flax.
- Photinia** Lindl. Rosaceae (II. 4). 17 sp. S.E. As., N. Am. [*P. japonica* Thunb. = *Eriobotrya japonica*.]
- Phragmites** Trin. Gramineae (x). 3 sp., 1 Argentine, 1 trop. As. and 1 cosmop. (incl. Brit.), *P. communis* L. the common reed. It has a creeping rhizome and tall upright stem with a dense panicle of spikelets. The lowest flr. of the spikelet is ♂, the rest are ♀. A few

cm. above the leaf-sheath are three transverse dents in the leaf (Teufelsbiss); these are due to pressure at the time when the rolled up blade is still in the sheaths of older leaves.

**Phryma** Linn. Phrymaceae. 1 sp. As., N. Am.

**Phrymaceae**. Dicotyledons (Sympet. Tubiflorae). Only genus *Phryma*; placed in Verbenaceae by Benth.-Hooker, but separated by Briquet in *Nat. Pfl.*; the chief distinction is the erect orthotropous ovule of *P.*; no transitions occur between this and other Verbenaceae.

**Phrynium** Loebl. Marantaceae. 20 sp. trop. As. and Afr.

**Phuopsis** Benth. et Hook. f. Rubiaceae (II. 21). 1 sp. Caucasus. Flrs. in heads, suited to Lepidoptera and bees. They are said to be explosive, the bud remaining closed and the style bursting out on contact with an insect.

**Phygelius** E. Mey. Scrophulariaceae (II. 6). 1 sp. S. Afr.

**Phyllica** Linn. Rhamnaceae. 65 sp. S. Afr. and neighbouring Is. Mostly xerophytic shrubs, often of heath-like habit with leaves rolled back (cf. *Empetrum*).

**Phyllachne** Forst. Candolleaceae. 9 sp. Austr., N. Z., S. Am.

**Phyllanthus** Linn. Euphorbiaceae (A. 1. 1). 400 sp. temp. and trop., exc. Eur. and N. As. The sp. of the trop. Am. sub-genus *Xylophylla* have flat green phylloclades bearing the flrs. on their margins. The ultimate shoots in the sub-genus *Euphyllanthus* look like pinnate leaves. In *P. cyclanthera* Baill. the ♂ flr. has its 3 sta. united into a synandrium with a ring-like anther at the top.

**Phyllarthron** DC. Bignoniaceae (IV). 6 sp. Madag., Mascarenes. The leaf is reduced to a jointed winged petiole.

**Phyllis** Linn. Rubiaceae (II. 17). 1 sp. Canaries, Madeira (p. 158).

**Phyllocactus** Link. Cactaceae (I). 13 sp. trop. Am., often epiphytic. Flat-stemmed plants (see order).

**Phyllocladus** Rich. Coniferae (Taxaceae, 4; see C. for genus characters). 3 sp. Tasm., N. Z., Borneo (celery pine). The 'short shoots' are represented by flat green leaf-like structures—phylloclades—whose stem-nature is easily recognised by their position in the axils of the scale leaves on the 'long shoots.' The edges of the phylloclades also bear scales. The flrs. (mon- or di-œcious) occupy the position of phylloclades. Each cpl. has one axillary erect ovule. The seed has a small basal aril. The timber is useful: the bark of *P. trichomanoides* D. Don is used for tanning.

**Phyllodoce** Salisb. = *Bryanthus* S. G. Gmel. *P. coerulea* Bab. = *B. taxifolius*.

**Phylloglossum** Kunze. Lycopodiaceae. 1 sp. *P. Drummondii* Kunze, in Austr. and N. Z. The tuber forms a protocorm (see order), which produces a crown of sterile leaves and a short unbranched stem, bearing at its apex a single cone of sporangia, like the cone of *Lycopodium*. "At the end of the growing season a new protocorm is formed. This arises directly from the apex of the old one where no

strobilus is developed, but in the latter case grows out upon a sort of peduncle from near the base of one of the leaves" (Campbell). The prothallus is almost entirely unknown.

**Phyllospadix** Hook. Potamogetonaceae. 2 sp. W. coast of N. Am. Dioecious.

**Physalis** Linn. Solanaceae (11). 45 sp. Am. *P. Alkekengi* L. (winter cherry) in Eur. and As. The berry of this sp. is edible, also that of *P. peruviana* L. (strawberry or gooseberry tomato, or cape gooseberry). It is enclosed in the bladdery persistent calyx, which becomes red.

**Phyospermum** Cusson. Umbelliferae (5). 5 sp. Eur., W. As.

**Physostegia** Benth. Labiatae (vi. 4). 3 sp. N. Am.

**Physostigma** Balf. Leguminosae (111. 10). 2 sp. trop. Afr. *P. venenosum* Balf. is the ordinal bean of Calabar. The floral structure is peculiar; the keel is spurred.

**Phytelephas** Ruiz et Pav. Palmae (v). 4 sp. trop. Am. This genus and *Nipa* are widely different from the other palms, exhibiting affinities to Pandanaceae and Cyclanthaceae (see *Nat. Pfl.*). *P.* is a short-stemmed palm with large pinnate radicle leaves, and dioecious infls. The ♂ infl. is a sausage-shaped spadix; the flr. has an irregular perianth and ∞ sta. with long filaments. The ♀ spadix is simple, with a spathe of several leaves, and about 6 flrs.; the flr. has an irregular perianth (an outer whorl of 3 and an inner of 5—10 longer leaves), numerous staminodes and usually a 5-loc. ovary with long style and stigmas. Each flr. gives a berry, and the actual fruit consists of 6 or more of these united together. The outer coat is hard, with woody protuberances. Each partial fruit contains several seeds; the endosperm (cellulose) is very hard (vegetable-ivory) and is used for turning into billiard balls &c. (Compare this fruit with those of *Pandanus* and *Carludovica*.)

**Phyteuma** Linn. Campanulaceae (1. 1). 40 sp. Medit., Eur., As. Two sp. of rampion, *P. orbiculare* L. and *P. spicatum* L. occur in the south of England. The floral mechanism is interesting (see order). The flrs. are comparatively small, and are massed together in heads. A tube is formed by the coherence of the tips of the long thin petals, within which the anthers are held. The style pushes up through this and drives the pollen gradually out at the end, where it is exposed to insects. Finally the style emerges, the stigmas open and the petals separate and fall back. [Compare carefully with *Campanula*, *Jasione* and *Compositae*.]

**Phytocrene** Wall. Icacinaceae 7 sp. India to New Guinea. They are twining shrubs, with very large vessels in the stem. If the stem be cut a considerable quantity of water escapes, which is drunk by the Malabar natives. The flrs. are dioecious.

**Phytolacca** Tourn. ex Linn. (incl. *Pircunia* Bert.). Phytolaccaceae. 11 sp. Am., Afr. Herbs with fleshy roots, or shrubs or trees. Flrs.

regular; P 5, A 10—20, G 7—10 or (7—10); in the latter case the fruit is a berry, in the former an aggregate of achenes or drupes.

**Phytolaccaceae.** Dicotyledons (Archichl. Centrospermae). 20 genera with 55 sp. chiefly trop. Am. and S. Afr. Herbs, shrubs, or trees, with racemose or cymose infls. of regular inconspicuous fls. P 4—5, A 4—5 or more (to  $\infty$ ), G 1— $\infty$  or (1— $\infty$ ). Ovaules 1 in each cpl., amphi- or campylotropous. Drupe or nut, rarely capsule. Seed with perisperm, often arillate. The fls. exhibit great variety in structure, owing to branching of sta. and different numbers and arrangements of cpls. (see *Nat. Pfl.*). Chief genera: Séguiera, Rivina, Phytolacca. Placed in Curvembryae by Benth.-Hooker and Warming. For relationships see Caryophyllaceae.

**Picea** Link. *Synonymy*: *P. vulgaris* Link (*Pinus Abies* L.) = *P. excelsa* Link; *P. canadensis* Link = *Tsuga canadensis*; *P. Pinsapo* Loud. = *Abies Pinsapo*; *P. rubra* A. Dietr. = *P. nigra* Link.

Coniferae (Arauc. 1 b; see C. for genus characters). 12 sp. N. temp. Long shoots only with needle leaves. Fls. single. Cones ripening in one year. *P. excelsa* is the Norway spruce or spruce-fir, found in Eur. from the Pyrenees, to 68° N. It furnishes valuable wood, resin, and turpentine. *P. alba* Link (silver fir, N. Am.) and others are also valuable.

**Picris** Linn. Compositae (XIII). 36 sp. Medit., N. tem., Abyss. 2 in Brit. Like *Leontodon*.

**Pilea** Lindl. Urticaceae (2). 100 sp. trop., several cultivated under the name artillery plant, given to them on account of the little smoke-like puffs of pollen ejected by the exploding sta. (cf. *Urtica*).

**Pilocarpus** Vahl. Rutaceae (v). 12 sp. trop. Am., W. Ind. The leaves of *P. pennatifolius* Lem. are the official 'folia Jaborandi'.

**Pilocereus** Lem. = *Cereus* Mill.

**Pilostyles** Guill. Rafflesiaceae. 8 sp., esp. trop. Am. Parasites on Leguminosae.

**Pilularia** Linn. Marsiliaceae. 3 sp. N. and S. temp. *P. globulifera* L., the pill-wort, is found on the margins of lakes in Brit. There is a creeping rhizome bearing roots on the lower surface and linear-erect leaves on the upper. The sporocarp is a pea-shaped structure, borne on the ventral side of a leaf-stalk. It has a hard outer coat and consists of four sori, each containing both micro- and mega-sporangia. The life history is like that of Marsilia.

**Pimelea** Banks et Soland. Thymelaeaceae. 80 sp. Austr., Tasm., N. Z., Timor. The fls. are in heads and are, in some sp. at least, protandrous with movement of sta. outwards.

**Pimenta** Lindl. Myrtaceae (1). 5 sp. trop. Am. The unripe fruits of *P. officinalis* Lindl., rapidly dried, form allspice.

**Pimpinella** (Riv.) Linn. Umbelliferae (5). 75 sp. cosmop. (exc. Austr.). 2 in Brit.; *P. Saxifraga* L. (bracket-saxifrage) is very

common. *P. Anisum* L. (Medit.) is the Anise, whose fruits (aniseed) are largely used in flavouring  
*Pinus* Blume. Palmæ (IV. 6) 40 sp. Indo-mal.

*Laguncula* Pourn. ex Linn. Lentibulariaceæ 30 sp. N. extra trop., Andes, Antarctic zone; 3 in Brit. (butterwort), of which *P. vulgaris* L. is common. It has a rhizome with a rosette of radical leaves arranged in phyllotaxy. The leaves are covered with glands, some sessile, some on stalks, secreting a sticky fluid to which small insects adhere. Rain washes them against the edge of the leaf, which is slightly upturned when stimulated by the presence of proteid bodies it rolls over upon itself and encloses them, and then the sessile glands secrete, ferment, digest the prey, and absorb the products (see p. 195), after which the leaf unrolls again. *P. lusitanica* L. is found on the western shores of Brit. and is one of a few sp. which have migrated thus far up the Atl. coasts (its home is Portugal)

*Pinus* (Touin.) Linn. Synonymy *P. Abies* L. (*P. excelsa* Lam.) = *Picea excelsa*; *P. alba* Ant. = *Picea alba* *P. balsamea* L. = *Abies balsamea*. *P. Cedrus* B. = *Cedrus Libani*, *P. Douglasi* Lamb = *Tsuga Douglasii*, *P. Larix* L. = *Larix europæa* *P. maritima* Lam. = *Pinaster*, *P. nigra* Ant. = *Picea nigra*, *P. Picia* L. = *Abies pectinata*.

Coniferae (Aruc. 1 b. see C. for genus characters) 70 sp. N. temp. and on Mts. in the N. tropics. They are evergreen, resinous trees with long and short shoots (see Coniferae). If a tree be examined in winter the main axes will be found each with a group of buds at the end, one terminal, the rest lateral. They are covered with resinous scale leaves. Each gives rise in spring to a 'long shoot' or shoot of unlimited growth, if it be the main axis of all, we see the terminal bud continue it, forming a year's growth before branching in a similar way again. The large branches thus form rough whorls marking each year's growth. On the stem of a long shoot no green leaves are directly borne, but only scales, first the bud scales above mentioned and then others in whose axils arise the 'short shoots', or shoots of limited growth. Each of these has a few scale leaves at the base of a very short stem and ends with 2 or more green leaves of needle shape. When there are two, their upper flat sides face one another. These needle leaves exhibit xerophile characters in a high degree, they are thick in proportion to surface exposed, they have a very stout epidermis with a hypoderm of thick walled cells, and the stomata are placed at the bottom of deep pits; the intercellular spaces too are very small.

The fls. take the form of the familiar cones, the ♂ being grouped together in spikes. Each flr. whether ♂ or ♀, occupies the position of a short shoot and of limited growth—an axis with a few scale-leaves below bearing a number of sporophylls. In the ♂ there are many stam., each with two pollen-sacs on the under side; the pollen is loose and powdery, and each grain has two bladder-like expansions of the cuticle

helping it to float in the air. In the ♀, the cpls. themselves are very small, but the ovuliferous scales, which show at the outside of the cone, are very large, and each bears two ovules at its base, with the micropyles facing the axis. The ♀ cones take 2 to 3 years before the seeds are ripe. In May of the first year, the first stage may be seen— young cones, about 1 cm. long, in the position of short shoots near the tip of the lengthening axis. Microscopic examination of these (see text-books) shows that the ovules are not ripe for fertilisation. In June (the time varies from year to year according to season) pollination takes place. The ♂ cones shed their pollen in great quantities, so that in a pine forest the air is often full of it (if it rain, the phenomenon of 'showers of sulphur' may occur), and the wind carries it about. At the same time the ovuliferous scales spread apart. If a grain fall between two of them it slips down to the micropyle of an ovule, where it becomes held by the sticky fluid then exuding. After a short time the ♀ cones close up again. The pollen grain is brought into contact with the nucellus by the drying up of the mucilage; it forms a short pollen-tube, and then a resting period comes on. Next year in May or June the ♀ cone has become a fat green body about 3 cm. long, with the ovules ready for fertilisation; the pollen-tubes now recommence growth and reach the ova. Then in the third year the cone is mature—a hard woody cone containing the seeds between the scales. Each seed contains an embryo with a whorl of cotyledons, embedded in rich endosperm, and has a hard testa. To the end of this is attached a thin membranous wing, derived from the ovuliferous scale. In dry weather the cone opens and the seeds are blown away by the wind. In germination the seed is lifted up above the earth by the growing plant and the cotyledons remain inside the testa till all the reserves are exhausted. It is noteworthy that they are green whilst in the seed, though in darkness—an exception to the rule that chlorophyll requires light for its formation. During the first year no short shoots are formed, and the seedling has green leaves borne directly on the main stem.

The pines are amongst the most valuable of all plants and are cultivated on an enormous scale, chiefly for their timber, which is easily worked, and resinous products. The resin renders the timber very resistant to decay, &c.

Some of the more important sp. will now be mentioned.

- I. *PINASTER* Endl. Visible part of fruit scale more or less pyramidal with central boss.

§ 1. *Pinea* (short shoot with 2 or rarely 1 needles): 20 sp.  
*P. sylvestris* L., the Scotch fir, the only British sp., occurs in Eur. to 68° N., in Asia to 66° N., and as far south as Spain and Italy (alpine). The wood (yellow deal) is largely used in the arts; turpentine is obtained by tapping the tree. The resin exudes and is distilled; the distillate is oil of

turpentine, the remainder rosin. Tar and pitch are correspondingly the products of destructive distillation in closed chambers. «*P. Pumilio* Haenke (*P. montana* Mill.) is a shrubby decumbent sp., Pyrenees to Caucasus. *P. Pinea* L. (Medit.), the stone pine, furnishes edible seeds ('pignons'). *P. Laricio* Poir. (S. Eur.) is the Corsican pine. *P. Pinaster* Ait., the cluster pine or pinaster (Medit.) is a valuable tree. It grows well near the sea, and large areas of the Landes of S. France are planted with it. It furnishes much of the turpentine &c. in use. *P. echinata* Mill. the short leaved or yellow pine is a valuable N. Am. sp.

- § 2. *Taeda* (needles 3, triangular in section): 16 sp. *P. Taeda* L., is the loblolly or frankincense pine of the southern U. S. It yields turpentine. *P. palustris* Mill. (*P. australis* Michx.) is the pitch-pine of the U. S. It yields timber and turpentine. Other sp., e.g. *P. ponderosa* Dougl. and *P. rigida* Mill., are also known by the name of pitch-pine.

II. *STROBUS* Spach. Visible part of fruit scale with terminal boss. Needles usually 5 in each short shoot. 20 sp.

- § 1. *Eustrobus* (cones hanging, seeds winged): *P. Strobus* L., the Weymouth pine (East N. Am.), a timber tree; *P. Lambertiana* Dougl., the giant sugar pine of the Western States; *P. excelsa* Wall., the Bhotan pine (E. India).

- § 2. *Cembra* (cones erect or drooping, seeds not winged); *P. Cembra* L. the Siberian cedar (Alps, Carpathians, Ural, Siber.) has edible seeds and valuable wood; *P. flexilis* James (N. Am.) &c. [For further details see *Nat. Pfl.*, Veitch's *Manual of Coniferae*, Muller's *Select Extratrop. Plants*, &c.]

**Piper** Linn. (incl. *Chavica* Miq.). Piperaceae. 600 sp. trop. mostly climbing shrubs. Flrs. in sympodial spikes, the bracts closely appressed to the axis. The fruit is a berry. That of *P. nigrum* L. gathered before it is ripe and dried, forms a black peppercorn; or if the outside be removed by maceration, a white one. *P. Cubeba* L. f. is the cubebs, *P. Betle* L. the Betel pepper (see *Areca*). See *Treas. of Bot.*

**Piperaceae.** Dicotyledons (Archichl. Piperales). 7 gen. with 1050 sp. trop. Plants of low organisation. Herbs or shrubs with undivided leaves with or without stipules; the leaves have a pungent taste. Flrs. naked, in spikes. Sta. 1—10. Cpls. (1—4); ovary 1-loc. with 1 basal orthotropous ovule. Seeds with dense perisperm round the endosperm; embryo small. The stem-anatomy is interesting. Piper is economically useful. *Chief genera:* Piper, Peperomia. Placed in Micrembrayae by Benth.-Hooker (who include Saururaceae in P.), in Polygoniflorae by Warming.

**Piperales.** The 1st cohort of Archichlamydeae (p. 136).



**Piptadenia** Benth. Leguminosae (1. 5). 40 sp. trop., esp. Am.

*rigida* Benth. (Brazil) yields Angico gum used like gum-arabic.

**Piptanthus** Sweet. Leguminosae (III. 2). 1 sp. Himalaya.

**Pircunia** Bert. = *Phytolacca* Linn.

**Pirola** Neck. = *Pyrola* Tourn.

**Pirus** Hall. = *Pyrus* Tourn.

**Pisonia** Plum. ex Linn. Nyctaginaceae (2). 40 sp., chiefly trop. The flrs. are generally unisexual. The anthocarp is glandular and is one of the few fruits which are able to cling to feathers. Forbes states that on Keeling Island the fruits adhere to the feathers of herons in such quantities as sometimes absolutely to cripple them, or even to cause their death.

**Pistacia** Linn. Anacardiaceae (III). 5 sp. Medit., 1 E. As., 1 Mexico.

Flrs. dioecious, apetalous or naked. Fruit a drupe. *P. Terebinthus*

L. yields Chian turpentine, *P. Lentiscus* L. the resin called mastic.

The fruits of *P. vera* L. are eaten under the name Pistachio nuts.

**Pistia** Linn. Araceae (VIII). 1 sp. trop. Am., Afr., As., *P. Stratiotes*

L., a floating water-plant, but rarely anchored by its roots to the soil, and therefore often blown about by wind. It is of sympodial structure, but the internodes remain short and bear a rosette of large leaves; these sleep at night, moving upwards from the nearly horizontal position which they occupy by day. The continuation shoots of the sympodium are axillary, but beside each leaf arises a stolon which grows out along the water and gives rise to a new plant. The infl. is small and monoecious; above is a whorl of ♂ flrs., each with a synandrium of 2 sta.; below is a ♀ flr. of 1 cpl. Both are naked. *P.* is a link between Lemnaceae and Araceae (q. v.).

**Pisum** (Tourn.) Linn. Leguminosae (III. 9). 6 sp. Medit. W. As.

*P. sativum* L. is the common pea. The floral mechanism resembles that of *Lathyrus*, but differs much in detail (see Müller).

**Pitcairnia** L'Hérit. Bromeliaceae (2). 70 sp. S. Am. Most are terrestrial; many form stolons at the base.

**Pithecolobium** Mart. Leguminosae (1. 1). 110 sp. trop. Stipules often thorny. Fruit often coiled up like that of *Medicago*. *P. Saman* Benth. (trop. S. Am.) is the rain tree, so called because of a legend that it was always raining under its branches. The ejections of juice by the Cicadas are responsible for this (cf. *Acer*, *Andira*).

**Pittosporaceae**. Dicotyledons (Archichl. Rosales). 10 gen. with 90 sp., confined (exc. *Pittosporum*) to Austr. Trees or shrubs, often climbing, with alt., leathery, evergreen, usually entire, exstip. leaves. Resin is present in large quantity in passages at the outer side of the bast. Flrs. ♀, regular, 5-merous; sta. hypogynous; cpls. 2 or more, forming a 1-loc. or multi-loc. ovary with parietal or axile placentation, and 2-ranked ∞ anatropous ovules; style simple. Fruit a capsule or berry with albuminous seeds. *Chief genera*: *Pittosporum*, *Billardiera*, *Sollya*. The relationships are very obscure (see *Nat. Pfl.*); it is

placed in Polygalinae by Benth.-Hooker, and in Saxifraginae by Warming.

**Pittosporum** Banks. Pittosporaceae. 70 sp. trop. and sub trop., Canaries to Japan and Sandwich Is. The seeds of some sp. are sticky. Some yield useful timber.

**Plagianthus** Forst. Malvaceae (II). 10 sp. Austr., N. Z.

**Plagiocheilus** Arn. Compositae (VII). 7 sp. S. Am.

**Planera** J. F. Gmel. Ulmaceae. 1 sp. U. S. *P. aquatica* J. F. Gmel., a useful timber tree.

**Plantaginaceae.** Dicotyledons (Sympet. Plantaginales). 3 gen. with 200 sp. cosmop. (See genera.) Annual or perennial herbs; leaves without distinction into stalk and blade, exstip. Flrs. usually in heads or spikes, inconspicuous, usually  $\bar{\sigma}$ , regular, without bracteoles, wind- or partly insect-fertilised. K (4), diagonally placed; C usually (4), membranous; A 4, with very long filaments and versatile anthers containing much powdery pollen; G usually (2), 2-loc., with 1— $\infty$  semi-anatropous ovules on axile placentae. Fruit a membranous capsule, opening with a lid cut off by a peripheral dehisence, or sometimes, a nut surrounded by the persistent calyx. Embryo straight, in fleshy endosperm. *Genera:* *Plantago*, *Littorella*, *Bougueria*. See P. and L. for details. The relationships of the P. are difficult to make out. The flr. is usually regarded as derived from a 5-merous type in the same way as that of *Veronica*, and most authors agree in regarding the P. as degraded forms allied to *Scrophulariaceae*, *Labiatae*, &c. The wind-pollination of the flr. is also an evidence of this. Benth.-Hooker place the P. as an anomalous order after *Labiatae*, Warming places them in *Personatae*.

**Plantaginales.** The 6th cohort of Sympetalaee (p. 140).

**Plantagineae.** (Benth.-Hooker) = Plantaginaceae.

**Plantago** (Tourn.) Linn. Plantaginaceae. About 200 sp. cosmop.; 5 in Brit. The Brit. sp. will serve as good illustrations of the genus. *P. major* L. (greater plantain) is a perennial with a thick root and a rosette of large erect leaves. In the axils of these arise the infls. (spikes). The flr. is markedly protogynous, the stigmas protruding from the bud; the sta. appear later. Wind-pollination is the rule, as the structure of the flrs. indicates (p. 84), but insects sometimes visit them for pollen. The fruit-spikes are often given as food to cage-birds. *P. media* L. (hoary plantain) shows similar general features, but the leaves lie flat on the ground (hence it is a most troublesome weed in lawns, &c.); they exhibit the 3/8 phyllotaxy (p. 36) very clearly. The flr. is more conspicuous than that of *P. major* and has a pleasant scent, and though primarily wind-pollinated, is largely visited for pollen in fine weather by drone-flies and bees. It is sometimes gynodioecious (cf. *Labiatae*). *P. lanceolata* L. (rib-wort plantain) has narrow erect leaves, and flrs., like those of the last sp., also gynodioecious. *P. coronopus* L. (buck's-horn plantain) is a xerophytic sp. with hairy leaves,

growing in sandy places. Many S. Am. sp. show very marked xerophilous characters—dense tufting, small hairy leaves, often grooved on the lower surface (cf. Ericaceae), &c. *P. maritima* L. (the sea-side plantain) has linear fleshy leaves (p. 188): it is frequently found at high levels in the Scottish Mts. (p. 189), though rarely in the intermediate regions.

The seeds of many sp. swell up when wetted and become mucilaginous (cf. *Linum*). Those of *P. Psyllium* L. (Medit.) are used in various ways in silk and cotton manufactures on account of this property; they have also been used in medicine.

If the young growing infl. of a *P.* be vigorously shaken, the spike when left to itself droops and only becomes erect again after a considerable time. This is due to the fact that the strain stretches the young cell walls beyond their limit of elasticity (see Sachs' *Lectures on the Physiology of Plants*, p. 220).

**Platanaceae.** Dicotyledons (Archichl. Rosales). Only genus *Platanus* (q.v.). The relationships of *P.* are obscure; it is placed in Unisemales by Benth.-Hooker, in Saxifraginae by Warming, and apparently comes nearest to Rosaceae and Hamamelidaceae.

**Platanthera** Rich. = *Habenaria* Willd.

**Platanus** (Tourn.) Linn. Platanaceae. 4 sp. N. temp. The plane-tree, *P. orientalis* L., is well known. The bark scales off every year, leaving a smooth surface. The axillary bud is developed under the base of the petiole, which fits over it like an extinguisher. The stipules are united round the stem. Flrs. monœcious in pendulous heads, wind-fertilised. K 4 or 3. Sta. 4 or 3, opposite sepals. Cpls. 4 or 3, apocarpous. Ovules orthotropous, pendulous. Multiple fruit, each cpl. giving a caryopsis, often winged. Seed albuminous. The wood of the plane is useful, and also that of the buttonwood of N. Am. *P. occidentalis* L.

**Platynerium** Desv. Polypodiaceae. 5 sp. Afr., Malaya, Austr. They are epiphytic, but sometimes grow on steep rock surfaces, and exhibit a very interesting structure. The rhizome is short and bears alternately leaves of two kinds. The young leaves are protected by hairs. Of the two kinds of leaves, the one stands more or less erect (the 'mantle' leaf) the other is pendulous, usually much branched and bears the sporangia in irregular areas on its lower surface. Assimilation is chiefly carried on by the pendulous leaves. Two types of mantle leaf occur, represented in *P. grande* J. Sm. and *P. alcinorne* Desv., the two common sp. In the former the base of the leaf, which is unbranched, clings closely to the supporting trunk, whilst the upper part spreads out and makes a niche in which humus collects; in this the roots ramify and absorb food. This plant grows to a great size. In *P. alcinorne* on the other hand the whole of the mantle leaf clings to the support, and the only humus-supply the roots have is that furnished by the decay of old mantle leaves and perhaps of the tree

bark. This sp. is comparatively small, but grows in great colonies, owing to the constant formation of new individuals by adventitious budding from the roots. In both sp. the bases of the leaves are rather fleshy and act as water stores.

The stag-horn ferns are favourites in hot-houses. Besides the two mentioned, *P. Wallichii* Hook. and *P. Willinckii* Moore are also grown. They have the habit of *P. grande*.

**Platycodon** A. DC. Campanulaceae (I. 1). 1 sp. E. As.

**Platylobium** Sm. Leguminosae (III. 3). 3 sp. Austr. The pods are much flattened and may be wind-dispersed.

**Platystemon** Benth. Papaveraceae (II). 1 sp. West N. Am., *P. californicus* Benth. Leaves in apparent whorls (see Papaveraceae).

**Platystigma** Benth. Papaveraceae (II). 3 sp. California, Oregon. Leaves as in Platystemon.

**Plectocomia** Mart. et Blume. Palmae (III. 5). 6 sp. Indo-mal. Climbers like Calamus; the hooked leaves are used for catching run-a-muck Malays.

**Electranthus** L'Hérit. Labiatae (VII). 70 sp. trop. Old World.

**Electritis** DC. = Valerianella Tourn.

**Electronia** Linn. Rubiaceae (II. 11). 80 sp. trop. Old World. Some have axillary thorns.

**Pleione** D. Don = Coeloglyne Lindl.

**Pleroma** D. Don = Tibouchina Aubl.

**Pleurothallis** R. Br. Orchidaceae (12). 400 sp. trop. Am.

**Pluchea** Cass. Compositae (IV). 30 sp. trop. and sub trop.

**Plumbaginaceae.** Dicotyledons (Sympet. Primulales). 10 gen. with 280 sp. cosmop., but esp. on salt steppes and sea-coast. 2 Brit. genera. Perennial herbs or shrubs with narrow leaves, on whose surface water glands occur, or sometimes chalk glands (cf. Saxifraga). The infl. is of various types, racemose and cymose (see Plumbago, Ceratostigma, Statice, Armeria), bracteolate. Flrs. regular, 5, 5-merous, the odd sepal posterior. Calyx persistent. Corolla often nearly polypetalous, convolute. Sta. 5, epipetalous and opposite the petals. Ovary superior, 1-loc., with basal placenta. One anatropous ovule, whose stalk projects up to the top of the loc. and thus causes the micropyle to be directed upwards. Styles or stigmas 5. Fruit a nut; embryo straight, in floury endosperm. The order is distinguished from Primulaceae by the ovary and styles. *Chief genera:* Plumbago, Ceratostigma, Acantholimon, Armeria, Statice, Limoniastrum. Placed in Primulales by Benth.-Hooker, in Primulinae by Warming.

**Plumbago** Tourn. ex Linn. Plumbaginaceae. 10 sp. Medit. and trop. Racemose infl. The calyx is covered with glandular hairs, and aids in seed-distribution.

**Plumeria** Tourn. ex Linn. Apocynaceae (I. 3). 40 sp. trop. Am. Several are cultivated for the beauty and sweetness of the flrs.

**Poa** Linn. Gramineae (X). 100 sp. temp.; 8 in Brit. (meadow grass).

Many are useful pasture-grasses.

**Pocockia** Ser. = *Trigonella* Linn.

**Podalyria** Lam. Leguminosae (III. 2). 20 sp. S. Afr.

**Podocarpus** (L'Hérit.) Pers. Coniferae (Taxac. 3; see C. for genus characters). 40 sp. E. As. and S. temp. and trop. Dioecious. The ♀ has a peculiar structure. There are usually three pairs of scales, decussate. One of the middle pair projects above all the rest, bearing an anatropous ovule. The other 5 are sometimes united to form the so-called receptacle. The fruit usually consists of a fleshy mass (the 'receptacle') bearing an arillate seed. In some sp. the sterile scales do not become fleshy. 'The timber is valuable.

**Podochilus** Blume. Orchidaceae (10). 12 sp. Indo-mal. Epiphytes.

**Podolepis** Labill. Compositae (IV). 13 sp. Austr.

**Podophyllum** Linn. Berberidaceae. 5 sp. N. temp. *P. peltatum* L. is best known. There is a rhizome which sends up yearly a shoot bearing two leaves. These are large and often peltate, and hang down in the young condition like a closed umbrella, thus gaining protection from heat, &c. A drug is prepared from the rhizome. The fruit is a berry, whose flesh consists chiefly of the placenta which grows up round the seeds (wrongly termed an aril in some text-books).

**Podostemaceae**. Dicotyledons (Archichl. Rosales). 22 gen. with 150 sp. trop. A very remarkable order of plants adapted to life in rushing water; they grow on rocks in rivers and are very local in distribution, contrary to the usual rule in water-plants. The morphology of the vegetative organs is extremely varied and complex and cannot be discussed here. [See *Nat. Pfl.* and Warming's series of papers on P. in *Kgl. Danske Vidensk. Selsk. Skrifter*, 1881, 82, 88, 91, &c. (abstracts in Just's *Jahresbericht*), also Goebel's *Pflanzenbiol. Sch.* II. 331.] The root functions as a rhizome, is dorsiventral in shape and structure, and contains chlorophyll (even possessing palisade tissue in certain cases); it frequently gives off branches that drift with the stream. The root-hairs have the properties of true roots and so cling to the substratum; special organs for this purpose (*kaptera*) are also developed exogenously from the roots. The shoots arise endogenously in the cortex of the root and have dichasial branching. Their chief function is to bear the fls., which appear when the water-level sinks. These are of simple type, usually ♂, regular or not. P 3—5 or (3—5), scale-like; A 1—∞, hypogynous; G, usually (2), 2-loc. with thick axile placenta. Ovules ∞, anatropous. Capsule. Seed exalbuminous. Chief genera (none in cultivation): *Weddellina*, *Podostemon*, *Lawia*, *Oenore*. The classification of the order is difficult. Warming places them near *Saxifragaceae* in *Saxifraginae* (i.e. in *Rosales* in *Nat. Pfl.*). Baillon puts them near *Caryophyllaceae*, Benth.-Hooker in *Monochlamydeae*, giving them a separate series (II. *Multiovulatae aquaticae*).

**Pogostemon** Desf. Labiatae (vl. 12). 32 sp. Indo-mal., Japan. *P. Patchouly* Pellet yields the well-known perfume by distillation.

**Poinciana** Tourn. ex Linn. Leguminosae (II. 7). 3 sp. trop. Afr. and As. *P. regia* Boj. is cultivated as an ornamental tree.

**Poinsettia** R. Grah. = *Euphorbia* Linn.

**Polanisia** Rafin. = *Cleome* Linn.

**Polemoniaceae**. Dicotyledons (Sympet. Tubiflorae). 8 gen. with about 200 sp., chiefly N. Am.; a few in Chili, Peru, Eur., N. As. Herbs (rarely shrubby below), glabrous or shortly hairy, with usually opp. exstip. leaves. Flrs. in cymes (sometimes condensed into involucrate heads),  $\bar{K}$  (5), valvate or imbricate, persistent;  $C$  (5), bell-funnel- or plate-shaped, usually convolute;  $A$  5, epipetalous, alt. with petals;  $\bar{G}$  (3) or rarely (2—5), on a disc, multiloc., with simple style more or less lobed at tip. Ovules 1— $\infty$  in each loc., anatropous, sessile. Fruit usually a loculicidal capsule. Embryo straight, in endosperm. *Chief genera*: *Cobaea*, *Cantua*, *Phlox*, *Collomia*, *Gilia*, *Polemonium* (mostly favourite border plants). Placed in Polemoniales by Benth.-Hooker, in Tubiflorae by Warming.

**Polemoniales** (Benth.-Hooker). The 8th cohort of Gamopetalae (p. 144)

**Polemonium** (Tourn.) Linn. Polemoniaceae. 14 sp. Eur., N. As., N. Am. *P. caeruleum* L. (Jacob's ladder) in Brit., but rare. The honey is protected by hairs at the base of the sta. (cf. *Hydrophyllaceae*).

**Pollanthes** Linn. Amaryllidaceae (II). 3 sp. Mexico. *P. tuberosa* L. (tuberose) is largely cultivated for its scented flrs.

**Polyalthia** Blume. Anonaceae (3). 70 sp. Old World trop.

**Polycarpicae** (Warming). The 8th cohort of Choripetalae (p. 146).

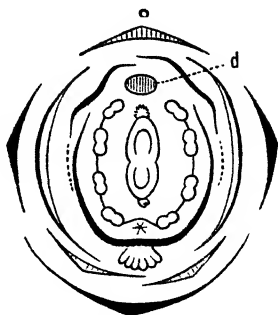
**Polycarpon** Loeffl. Caryophyllaceae (II. 3). 7 sp. temp. and subtrop. *P. tetraphyllum* L. (polycarp or allseed) in Brit.

**Polycnemum** Linn. Chenopodiaceae (1). 5 sp. Eur. The structure of the fruit is curious, a ridge developing at its apex after fertilisation.

**Polygala** (Tourn.) Linn. Polygalaceae. 450 sp. cosmop. exc. N. Z., Polynes., and Arctic zone. A few have stipular thorns. *P. vulgaris* L. (milk-wort) is common on moors in Brit. The flrs. owe their conspicuousness to the two coloured sepals; they occur in three colours, red, white, and blue, usually on different plants but sometimes on the same one. The essential organs in most sp. are contained in the keel and emerge from it, as in Leguminosae, when it is depressed by a visiting insect. *P. Senega* L. (Senega snake-root) in N. Am. is medicinal.

**Polygalaceae**. Dicotyledons (Archichl. Geraniales). 10 gen. with 700 sp., cosmop. exc. N. Z., Polynes., and Arctic zone. Herbs, shrubs, or small trees with simple entire alt. opp. or whorled usually exstip. leaves; the stipules when present are usually thorny or scaly.

Infl. a raceme, spike, or panicle, with bracts and bracteoles. Flr. diplochlam., medially zygomorphic. K usually 5, rarely (5), the 2 inner sepals (*alae*) often large and petaloid; C 5, rarely all present usually only 3—the lowest and two upper—more or less joined to sta.-tube, the median anterior petal keel-like and often with a terminal brush; A in two 5-merous whorls, usually only 8, or 7, 5, 4 or 3, usually united below into an open tube;  $\bar{G}$  (5—2), usually (2); antero-posterior; ovary 2-loc. with 1 anatropous pendulous ovule in each loc. (rarely 1-loc. with  $\infty$  ovules). Capsule, nut or drupe. Endosperm or not. The floral mechanism, like the structure, resembles that found in many Leguminosae. *Chief genera*: Polygala, Securidaca, Xanthophyllum. Placed in Polygalinae by Benth.-Hooker, in Aesculinae by Warming. [See Krameria.]



Floral diagram of *Polygala myrtilifolia* (after Eichler): the gland *d* as in *P. Chamæbuxus*. Petals and bracts black; the missing petals represented by dotted lines, the missing sta. by \*.

**Polygaleae** (Benth.-Hooker) = Polygalaceae.

**Polygalinae** (Benth.-Hooker). The 3rd cohort of Polypetalae (p. 141).

**Polygonaceae**. Dicotyledons (Archichl. Polygonales). 30 gen. with 750 sp. chiefly N. temp.; a few trop., arctic, and S. hemisph. Most are herbs whose leaves (exc. *Eriogonaceae*) possess a peculiar sheathing stipule or *ochrea* (ocrea) clasping the stem above the leaf-base. This forms a characteristic feature of the order. The infl. is primarily racemose, but the partial infls. are usually cymose. [See *Eriogonum*. The flrs. are  $\bar{g}$ , regular, cyclic or acyclic. The former have usually the formula  $P\ 3+3$ , homochlamydeous;  $A\ 3+3$ ,  $\bar{G}\ (3)$ ; but many vary from this type. *Oxyria* is 2-merous; others, e.g. *Eriogonum*, *Rheum*, have 'dédoublement' of the outer sta. The acyclic flrs. have  $P\ 5$ , arranged according to the  $2/5$  phyllotaxy (e.g. *Polygonum*),  $A\ 5-8$ ,  $G\ (3)$ . Ovary 1-loc. with 1 erect orthotropous ovule and 3 styles. The flrs. are pollinated by wind or by insects. The fruit is almost always a triangular nut, with smooth exterior. The seed contains an excentric curved or straight embryo surrounded by mealy endosperm, sometimes ruminate. The fruits are usually wind-distributed; the commonest type of mechanism is that the persistent perianth forms a membranous wing round the fruit. Other fruits are provided with hooks for carriage by animals. See individual genera or Dammer in *Nat. Pfl.*

*Classification and chief genera* (after Dammer):

A. Flower cyclic, endosperm not ruminate.

I. *RUMICOIDEAE*.

1. *Eriogonae* (no ochrea): *Chorizanthe*, *Eriogonum*.
2. *Rumiceae* (ochreate): *Rumex*, *Rheum*, *Oxyria*.

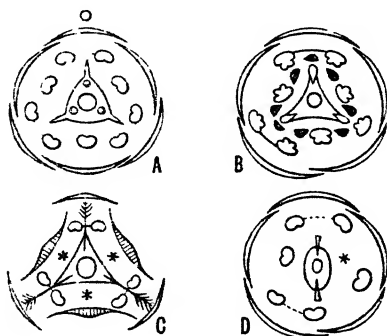
B. Acyclic (except a few *Coccoloboideae*)II. *POLYGONOIDEAE* (endosperm not ruminant).

3. *Atraphaxideae* (shrubs): *Calligonum*.
4. *Polygoneae* (herbs): *Polygonum*, *Fagopyrum*.

III. *COCCOLOBOIDEAE* (ruminant).

5. *Coccolobeae* (usually ♀): *Muehlenbeckia*, *Coccoloba*.
6. *Triplarideae* (usually dioecious): *Triplaris*.

[Placed in *Curvembryae* by Benth.-Hooker, in *Polygoniflorae* by Warming.]



Floral diagrams after Eichler). *A*, *Rheum*; *B*, *Polygonum tataricum*; *C*, *Rumex*; *D*, *Polygonum lapathifolium*. Bracts and bracteoles are omitted, and in *C* and *D* the axis also. Glands in *B* shaded. The asterisks represent missing sta.

**Polygonales.** The 9th cohort of Archichlamydeae (p. 137).

**Polygonatum** (Tourn.) Adans. *Liliaceae* (VII). 25 sp. N. temp.; 3 in Brit. (Solomon's seal). There is a sympodial fleshy rhizome, upon which the annual shoots leave curious seal-like marks when they die away. Infl. unilateral; flr. homogamous, bee-pollinated.

**Polygoniflorae** (Warming). The 5th cohort of Choripetalae (p. 146).

**Polygonum** (Tourn.) Linn. *Polygonaceae* (II. 4). 150 sp. universal, but esp. temp. (11 in Brit., knot-grass, bistort, &c.). In habit the genus varies much, though all are herbaceous. Some are xerophytes, some water plants (e.g. our common *P. amphibium* L., which may however be found almost as often on land where its leaves have not the stalks of the water form). The flrs. are in spikes and panicles (the partial infl. is cymose). Flrs. ♂, acyclic, usually with a coloured 5-leaved perianth and about 8 sta. Honey is secreted at the base of



the sta., and the flrs. are visited by insects, but in very varying degree (see the interesting series of sp. described by Müller in *Fert. of Flrs.* p. 509). Cleistogamic flrs. are found under the ochrea in *P. aviculare* L. &c., and this sp. also is said to possess subterranean cleistogamic flrs. In *P. viviparum* L. (an alpine Brit. sp.) many of the flrs. are replaced by bulbils in the lower part of the infl. (cf. *Lilium*, *Allium*). [For *P. Fagopyrum* L. see *Fagopyrum*.]

**Polypetalae** (Benth.-Hooker). A division of Dicotyledons (p. 141).

**Polypodiaceae.** Filicineae Leptosporangiatæ (Homosporous). 55 gen. with 3000 sp., cosmop. Mostly herbaceous perennials with a creeping rhizome or erect root-stock; many are epiphytic. Leaves usually large and pinnate, with sori on the lower sides. Each sorus consists usually of a large number of stalked sporangia, each with a vertical incomplete annulus and dehiscing transversely. An indusium may or may not be present. *Chief genera:* *Acrostichum*, *Davallia*, *Pteris*, *Polypodium*, *Platycerium*, *Adiantum*, *Asplenium*, *Aspidium*, *Nephrodium*.

**Polypodium** Linn. Polypodiaceae. 400 sp. cosmop. Several occur in Brit., viz. *P. alpestre* Hoppe, *P. Dryopteris* L. (oak-fern), *P. Phegopteris* L. (beech-fern), *P. vulgare* L. (common polypody). They have circular naked sori. Many trop. sp. are epiphytic and show interesting features. The rhizomes creep over the supporting tree, and humus is collected in niches formed between it and the leaves. An ordinary *P.* leaf with its bare petiole below would be useless, but these sp. have leaves whose blade reaches down to the base. *P. Heracleum* Kze. is a good example. *P. quercifolium* L. and others are still more interesting, as they exhibit two kinds of leaves, the one of the ordinary branched type, projecting out from the support and serving for assimilation and spore-bearing, the others small leaves like those of the oak, close to the rhizome, forming humus-collecting niches (cf. *Platycerium*, and see Goebel *Pflanzenbiol. Sch.* 1. p. 216).

**Polypogon** Desf. Gramineae (viii). 10 sp. warm temp. and trop.; 2 in Brit. rare (beard-grass).

**Polystachya** Hook. Orchidaceae (9). 40 sp. trop., esp. Afr.

**Pomaceae** (Warming). = Rosaceae (sub-order II).

**Pomaderris** Labill. Rhamnaceae. 20 sp. Austr., N. Z.

**Pontederia** Linn. Pontederiaceae. 2 sp. Am. Flrs. trimorphic, heterostyled (cf. *Lythrum*). *P. crassipes* Mart. = *Eichhornia crassipes*.

**Pontederiaceae.** Monocotyledons (Farinosae). 6 gen. with 21 sp. trop. Water plants (p. 168), floating or rooted, of sympodial structure, the successive axes ending in infls. (sympodial cymose pseudoracemes). Often, e.g. in *Eichhornia*, the axillary shoot is adnate to the main shoot from which it springs (p. 34). Sometimes extra branches are formed, and the axis of the infl. is often pushed to one side so that it appears to spring from a leaf-sheath. Fls. zygomorphic. P (3+3), persistent; A 3+3, epiphyllous, G (3), 3-loc. with ∞ anatropous ovules, or 1-loc. with 1 ovule; style long, stigma entire or

slightly lobed. Capsule or nut. Embryo central in the seed, scarcely, or not, shorter than the rich mealy endosperm. *Chief genera*: Eichhornia, Pontederia. Placed in Coronarieae by Benth.-Hooker, in Liliiflorae by Warming.

**Populus** Linn. Salicaceae. 18 sp. N. temp. *P. alba* L. (white poplar) and *P. tremula* L. (aspen) in Brit. Like *Salix* in most features, but the flrs. are wind-pollinated and have no honey; correlated with this is the fact that they have usually more sta. than those of *Salix*. The wood of *P. alba* is useful, and also that of *P. nigra* L. (black poplar) with its variety *pyramidalis* Spach (*P. fastigiata* Desf.), the Lombardy poplar, often grown in parks &c., *P. canadensis* Michx. (cotton-wood tree, N. Am.) and others. *P. balsamifera* L. is the balsam poplar, and yields a resin known as Tacamahac (see Calophyllum).

**Porana** Burm. f. Convolvulaceae (1. 4). 10 sp. Indo-mal., Austr.

**Portieria** Ruiz et Pav. Zygophyllaceae. 3 sp. Mexico and Andes. The leaflets of *P. hygrometrica* Ruiz et Pav. spread out horizontally at night, but during the day are folded up in pairs against one another, avoiding excessive transpiration.

**Porrum** (Tourn.) Linn. = *Allium* Tourn.

**Portulaca** Linn. Portulacaceae. 20 sp. trop. and sub trop. The flr. has a semi-inferior ovary and 4— $\infty$  sta. It is homogamous with self-fertilisation on withering, and remains closed in bad weather. The sta. of *P. oleracea* L. are sensitive to contact and move toward the side touched.

**Portulacaceae**. Dicotyledons (Archichl. Centrospermae). 17 gen. with 144 sp., cosmop., but esp. Am. Most are annual herbs, often with fleshy leaves, and with stipules (sometimes represented by axillary bundles of hairs). Flrs. usually in cymes (often dichasia with tendency to cincinni), regular,  $\bar{\gamma}$ . K 2, the lower sepal (usually anterior) overlapping the upper (the two are often regarded as bracteoles); C 5; A 5 + 5, or 5 opp. the petals, or some other number;  $\bar{C}_2$  (2—8) usually (3), superior exc. in *Portulaca*, 1-loc. with several stigmas and 2— $\infty$  campylotropous ovules on a central basal placenta. The flrs. secrete honey and are mostly insect-pollinated. Fruit a capsule with albuminous seeds; that of *Claytonia* and *Montia* is explosive; embryo more or less curved round the perisperm. *Chief genera*: *Calandrinia*, *Spraguea*, *Claytonia*, *Montia*, *Portulaca*, *Lewisia*. Placed in Caryophyllinae by Benth.-Hooker, in Curvembryae by Warming.

**Portulacaeae** (Benth.-Hooker) = Portulacaceae.

**Portulacaria** Jacq. Portulacaceae. 2 sp. S. Afr.

**Posidonia** Kon. Potamogetonaceae. 2 sp. Austr., Medit.

**Posoqueria** Aubl. Rubiaceae (1. 8). 5 sp. S. Am.

**Potamogeton** (Tourn.) Linn. Potamogetonaceae. 50 sp. cosmop. 11 or more (cf. *Rubus*) in Brit. (pond-weed). Water plants with creeping sympodial rhizomes and erect leafy branches; leaves all submerged or some floating. A whole series of types occurs, begin-

ning with the floating sp. and ending with the narrow-leaved submerged ones (see p. 169). There can be no doubt of the origin of the *P.* from land plants, and Schenck looks upon *P. natans* L. as the sp. least modified to suit a water existence, *i.e.* the nearest to the ancestral type. The upper leaves are ovate, leathery, and float on the water; the lower are submerged, and sometimes reduced to a linear form. Then come such sp. as *P. heterophyllus* Schreb. where the submerged leaves are all narrow. Next *P. lucens* L., *P. crispus* L., &c. with all the leaves lanceolate and submerged. Then in *P. obtusifolius* Mert. et Koch, *P. pusillus* L., &c., the leaves are narrow and of a long ribbon shape. *P. trichoides* Cham. et Schlecht. represents the most highly modified type of all. [All the above are Brit. sp.; they are best studied at first in a herbarium, for *P.* is as variable a genus as *Rubus* or *Hieracium*, and the sp. are exceedingly difficult to determine. The fact is that probably the genus is still in a condition of rapid evolution of which the sp. above mentioned represent various stages.] Interesting phenomena connected with the above are to be seen in the germination of the seeds. The internal anatomy also shows interesting features in the series of types mentioned.

Hibernation occurs in different ways; some sp. remain green all winter; *P. natans*, &c. die down and leave only the rhizome; *P. pectinatus* L. forms peculiar tubers on special branches (Schenk, *Wassergewächse*, p. 86); *P. crispus* and others form winter buds with broad leaves (not closely packed as in *Utricularia* &c., but wavy, like holly leaves); *P. obtusifolius* forms winter buds of the ordinary kind. The flrs. are of simple structure, arranged in spikes which project above the water. Each has 4 sta. in two whorls, and 4 cpls. From the connective of each sessile anther there grows out a cup-shaped expansion simulating a perianth leaf. The flr. is protogynous and wind-fertilised. The outer layer of the pericarp contains air, so that the fruit, which is an achene, floats on the water and may thus be carried to a distance, finally sinking when the air escapes. [For further details see p. 168 and Literature on p. 204.]

**Potamogetonaceae.** Monocotyledons (Helobieae). 9 gen. with 70 sp. cosmop. All are water plants, several of them being marine. There is in most a creeping stem or rhizome, mono- or sym-podial, attached to the soil by adventitious roots, and sending off erect branches upwards into the water. These usually have ribbon leaves, submerged (exceptions occur in *Potamogeton*), arranged in  $\frac{1}{2}$  phyllotaxy. The base is sheathing, and within the sheath are the small scales (*squamulae intravaginales*) which occur in most of the orders of Helobieae. The infl. is a spike or cyme, or the flrs. solitary. The flrs. possess no true perianth (exc. *Zannichellia* ?), but *Potamogeton* shows leaf-like outgrowths from the sta. which perform the perianth functions; similar structures occur in *Zostera* and *Ruppia*. In several genera it is not easy to decide what is to be regarded as the flr. (see *Zostera*).

Flr. ♂ or unisex., regular, 1—4-merous. Cpls. free or only 1. Ovules 1 in each cpl., pendulous, orthotropous. Fruit one-seeded. No endosperm. Embryo with well developed hypocotyl. For details see genera.

*Chief genera :*

A. Flrs. in spikes :

1. salt water : *Zostera*, *Phyllospadix*, *Posidonia*, *Ruppia*.
2. fresh or brackish : *Potamogeton*.

B. Flrs. in cymes or solitary : *Cymodocea*, *Zannichellia*.

[Benth.-Hooker unite *P.* to *Aponogetonaceae*, *Juncaginaceae* and *Naiadaceae*, and place the whole order (*Naiadeae*) in *Apocarpae*. Warming places it in *Helobieae*.]

**Potentilla** Linn. (incl. *Comarum* Linn., *Sibbaldia* Linn., *Tormentilla* Linn.). Rosaceae (III. 6b). 200 sp. chiefly N. temp. and arctic, a few S. temp. and Andes; 9 in Brit., incl. *P. Anserina* L. (silverweed), *P. reptans* L. (cinquefoil), *P. Comarum* Nestl., *P. Tormentilla* Neck. (tormentil), &c. Herbs, usually with creeping stems which root at the nodes and thus multiply the plant vegetatively. There is a well-marked *epicalyx* of small green leaves outside and alt. with the sepals. These are the stipules of the sepals united in pairs; often one or more of them may be seen with two lobes or even completely divided. Flrs. homogamous, fly-visited; honey is secreted by a ring-shaped nectary within the sta.

**Poterium** Linn. (incl. *Sanguisorba* Rupp. ex Linn.). Rosaceae (III. 9). 30 sp. N. temp.; 2 in Brit. (burnet). *P. Sanguisorba* L. is anemophilous with long pendulous sta. (cf. *Thalictrum*, *Artemisia*); it is also gynomonœcious, the ♀ flrs. at the top of the spike opening first, and afterwards the ♂ flrs. below. *P. (S.) officinale* A. Gray shows more trace of its entomophilous ancestry; the sta. are rigid and of a reddish colour, the stigma is less branched, and there is a nectary round the style (cf. *Rumex* and *Rheum*).

**Pothos** Linn. Araceae (I). 30 sp. trop. As., Madagascar. Monopodial (see order). Stem climbing, with adventitious roots. The buds break through the leaf-axils, so that the branching seems infra-axillary. Flr. ♀. P 3+3.

**Pourthiaea** Dcne. Rosaceae (II. 4). 5 sp. E. As.

**Pouzolzia** Gaudich. Urticaceae (3). 35 sp. Old World trop. The root of *P. tuberosa* Wight is eaten in India.

**Prangos** Lindl. Umbelliferae (6). 30 sp. Medit., Cent. As.

**Prasium** Linn. Labiatae (III). 1 sp. Medit.

**Pratia** Gaudich. Campanulaceae (III). 16 sp. S. Am., Austr., trop. As.

**Premna** Linn. Verbenaceae (IV). 40 sp. trop. and subtrop. (exc. Am.).

**Prenanthes** Vaill. ex Linn. Compositae (XIII). 27 sp. N. temp. and Afr.

**Priestleya** DC. Leguminosae (III. 3). 15 sp. S. Afr.

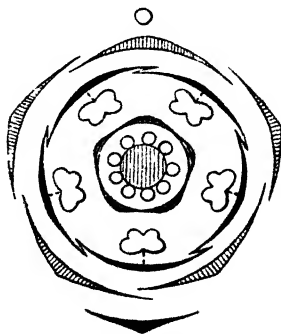
**Primula** Linn. Primulaceae (I). 146 sp., N. hemisph. chiefly in hilly

districts. A few occur elsewhere, e.g. *P. farinosa* L., var. *magellanica* Hook. at the Str. of Magelhaen. The rhizome is a sympodium, each joint terminating in an infl. In some sp. this consists of successive whorls of flrs. arranged up a long stalk, e.g. *P. japonica* A. Gray. The genus has been monographed by Pax (see *Nat. Pfl.*). A few of the more important sp. are: *P. sinensis* Sabine, the Chinese primrose, *P. elatior* Hill, the oxlip (Brit.), *P. vulgaris* Huds. (*P. acaulis* Hill), the primrose (Brit.), *P. veris* Lehm. (*P. officinalis* Jacq.), the cowslip (Brit.), *P. farinosa* L. (Brit.), *P. japonica* A. Gray, a most beautiful plant, not as often cultivated as it deserves to be, *P. Auricula* L., the auricula with its many forms. A great many hybrids also occur, and garden varieties. An interesting one is the double crowned cowslip, in which the calyx has become petaloid, so that the flr. looks as if it had two corollas, one within the other.

The flrs. of *P.* are dimorphic, heterostyled. On one plant are found long-styled flrs., with sta. halfway up the tube of the corolla and the stigma at its mouth; on another plant are short-styled flrs., with stigma halfway up and anthers at the mouth. The depth and narrowness of the tube render the flr. adapted to bees or butterflies, and these will tend to carry pollen from long sta. to long style or from short sta. to short style. These 'legitimate' pollinations (see *Lythrum* and p. 88) which are at the same time crossings, are the only ones which produce a full complement of fertile seed.

The flower stalks in the umbellate forms, e.g. cowslip, stand close and erect till the flrs. open, then they spread out, and close up again as the fruit ripens; thus the capsule is held erect and the seeds must be shaken out.

**Primulaceae.** Dicotyledons (Sympet. Primulales). 28 gen. with 350 sp. cosmop., but esp. N. temp. There are 9 Brit. genera, representing all but one of the suborders. They are herbaceous plants, commonly perennial, with rhizomes or tubers; leaves opp. or alt., exstip. The flrs. are often borne on scapes, which when more than one flowered are terminal; they are usually actinomorphic, ♀, often heterostyled, and 5-merous, without bracteoles, the odd (4th) sepal posterior. K (5) persistent; C (5), regular (exc. *Coris*), or 5, or 0 (*Gilax*); A 5, epipetalous and opposite the petals; occasionally 5 staminodes alternate with the petals; anthers introrse. The presence of the staminodes here as in *Myrsinaceae*, explains the antepetalous position of the sta. as due



Floral diagram of *Primula acaulis* (after Eichler).

to the abortion of the originally outer whorl. Much discussion took place on this subject in former times, especially after Pfeffer's discovery of the peculiar development of the corolla from the backs of the sta. (see Eichler, *Blüthendiag.* or Asa Gray, *Struct. Bot.* p. 197). Ovary superior or half-inferior (*Samolus*), syncarpous with free central placenta, typically of 5 cpls., but this is not easily proved, as no partitions (cf. *Caryophyllaceae*) are found in the ovary and the style and stigma are simple. The capsule splits into 5 valves, and monstrous flrs. with 5 leaves in place of the ovary occur; hence we may perhaps assume 5 cpls. Ovules  $\infty$ , spirally or in whorls on the placenta, semi-anatropous. The morphology of the free-central placenta has also been a subject of dispute (see Pax in *Nat. Pfl.*, or Eichler, *Blüthendiag.*).

A great number of the P. have heterostyled flowers (*Primula*, *Hottonia*, *Glaux*, *Androsace*, &c., *q.v.* for details).

The fruit is a capsule, dehiscing in various ways, but usually by teeth at the tip, one opposite to each sepal. Seeds few or many; embryo small, in fleshy endosperm.

*Classification and chief genera (after Pax):*

A. Flowers regular. Calyx not spiny.

a. Limb of corolla never bent back on tube.

aa. Corolla aestivation quincuncial.

I. *Primuleae* (ovary sup.): *Primula*, *Androsace*, *Soldanella*, *Hottonia*.

II. *Samoleae* (ovary semi-inf.): *Samolus* (only genus).

$\beta$ . Aestivation convolute.

III. *Lysimachieae*: *Lysimachia*, *Steironema*, *Trientalis*, *Glaux*, *Anagallis*, *Centunculus*.

b. Limb of corolla bent back.

IV. *Cyclamineae*: *Cyclamen*, *Dodecatheon* (only genera).

B. Flowers medially zygomorphic. Calyx spiny.

V. *Corideae*: *Coris* (only genus).

[Placed in *Primulales* by Benth.-Hooker, in *Primulinae* by Warming.]

**Primulales.** The 2nd cohort (Engler) of *Sympetalae* (p. 139). The 5th cohort (Benth.-Hooker) of *Gamopetalae* (p. 143).

**Primulinae** (Warming). The 3rd cohort of *Sympetalae* (p. 146).

**Principes.** The 4th cohort of *Monocotyledons* (p. 135).

**Pringlea** Anders. *Cruciferae* (I. 1). *P. antiscorbutica* R. Br., the Kerguelen cabbage, is the only sp. It has the habit of a cabbage, with the flrs. borne on lateral axes, and is a valuable remedy against scurvy on account of its essential oil. It grows only "on the tempestuous shores of Kerguelen's I., where winged insects cannot exist, because at every flight they run the risk of being drowned. Under these circumstances the plant has become modified for fertilisation by the wind, acquiring exerted anthers and long filiform stigmatic

papillae. It still retains traces of its descent from entomophilous ancestors; for while on the great part of the island it is devoid of petals, it occurs abundantly in shaded places with petals" (Müller).

**Prinos** Gronov. ex Linn. = *Ilex* Tourn.

**Prionium** E. Mey. Juncaceae. 1 sp. Cape Col., *P. Palmita* E. Mey. (*P. serratum* Buchen.), the Palmiet, a shrubby aloe-like plant with a stem 1—2 metres high, covered with the fibrous remains of old leaves. It grows on the edges of streams, sometimes almost blocking them up. Vegetative propagation takes place by the formation of runners. Adventitious roots are formed between the leaves. [See Buchenau in *Bibliotheca Botanica*, No. 27.]

**Pritchardia** Seem. et H. Wendl. (excl. *Washingtonia* H. Wendl.). Palmae (1. 2). 5 sp. west U.S., Sandwich Is.

**Priva** Adans. Verbenaceae (11). 10 sp. trop. and sub trop. The leaves of *P. echinata* Juss. are used in Am. as tea. The tubers of *P. laevis* Juss. are edible.

**Pröbosidea** Schmid. = *Martynia* Houst.

**Procris** Comm. ex Juss. Urticaceae (2). 5 sp. trop.

**Prosopis**. Leguminosae (1. 4). 25 sp. trop. and sub trop. Some are xerophytes, without leaves. Many are thorny, the thorns being epidermal, or metamorphosed branches or stipules. *P. juliflora* DC. is the mezquit tree. *P. alba* Griseb. has sweet succulent pods (*Algaroba blanca*), used as food.

**Prostanthera** Labill. Labiatae (11). 40 sp. Austr.

**Protea** Linn. Proteaceae (1). 60 sp. Cape Colony. Flrs. in showy heads, often with coloured bracts.

**Proteaceae**. Dicotyledons (Archichl. Proteales). 50 gen. with 960 sp. "which have a very characteristic distribution; there are in Austr. 591, trop. E. As. 25, New Caled. 27, N. Z. 2, Chili 7, trop. S. Am. 36, south-west Cape Col. 262, Madag. 2, Mts. of trop. Afr. 5" (Engler). A consideration of the above figures will show that the great majority of the order lives in regions where there is annually a long dry season. Correlated with this is the fact that these plants are mostly of xerophytic habit (p. 178). They are nearly all shrubs and trees with entire or much-divided exstip. leaves, which have commonly a thick cuticle and often a covering of hairs further to check transpiration. They also exhibit in their internal anatomy various xerophytic characters (see *Nat. Pfl.*). The flrs. are borne in racemes, spikes, heads &c., and are often very showy; it is noteworthy that many have their pollen freely exposed, though they are not wind-fertilised—another peculiarity connected with their life in a dry climate (compare the Acacias of Australia).

The flrs. are usually ♂, often zygomorphic. Perianth (4), corolline, valvate; the leaves commonly bent or rolled back when open; sta. 4, inserted on the tepals, and usually with only the anthers free; G 1, ovules many or few or one, pendulous or not, the micropyle

facing the base of the ovary. The style is terminal, long, often bent inwards. Fruit a follicle, capsule, drupe or nut. Seed exalbuminous. The ovary is sometimes borne on a gynophore and at its base are commonly nectarial outgrowths. The flrs. are protandrous and adapted to insect-fertilisation.

*Classification and chief genera* (see discussion in *Nat. Pfl.*).

I. *PERSOONIOIDEAE* (flrs. single in axils of bracts; ovules seldom few or 2; drupé or nut, one seeded): *Persoonia*, *Protea*, *Leucadendron*.

II. *GREVILLOIDEAE* (flrs. in pairs; ovules several or 2; fruit usually dehiscent and many seeded): *Grevillea*, *Hakea*, *Banksia*.

[Placed in Daphnales by Benth.-Hooker, in Thymelaeinae by Warming.]

**Proteales.** The 6th cohort of Archichlamydeae (p. 136).

**Protium** Burm. f. Burseraceae. 50 sp. trop. Am. Some yield resins.

**Prunella** Linn. (*Brunella* Tourn.) Labiatae (vi. 4). *P. vulgaris* L. (self-heal) is cosmop. (incl. Brit.), the other 5 sp. Medit. Eur. The fruiting calyx is closed and points upwards in dry air, but opens and stands horizontally in damp.

**Prunus** (Tourn.) Linn. (incl. *Amygdalus* Tourn., *Cerasus* Tourn.). Rosaceae (v. 12). 75 sp. N. temp.; a few trop. *P. insititia* L. (bullace), *P. spinosa* L. (sloe or blackthorn), *P. Avium* L. (gean), *P. Padus* L. (bird-cherry), in Brit. The flr.-buds are laid down in August or September of the preceding year. There is 1 cpl., which gives rise to a drupe, while the hollow receptacle usually falls away. Many sp. are cultivated for their fruit, e.g. *P. Armeniaca* L. (apricot), *P. domestica* L. (plum, prune), *P. Amygdalus* Stokes (almond), *P. Persica* Stokes (peach, with its smooth-fruited variety the nectarine), *P. Cerasus* L. (cherry), &c. *P. Laurocerasus* L. is the cherry laurel; it has extra-floral nectaries (p. 117) on the backs of the leaves, showing as brownish patches against the midribs. The spines of some sp. are axillary, as in *Crataegus*.

**Psamma** Beauv. = *Ammophila* Host.

**Pseuderanthemum** Radlkf. Acanthaceae (iv. B). 60 sp. trop.

**Pseudolarix** Gord. Coniferae (i. 1 b). 1 sp. *P. Kaempferi* Gord., the golden pine, China. Like *Larix*, but distinguished chiefly by the deciduous fruit-scales.

**Pseudotsuga** Carr. = *Tsuga* Carr.

**Psidium** Linn. Myrtaceae (1). 100 sp. trop. Am. Many yield edible fruit, e.g. *P. Guajava* L., the guava.

**Psilotaceae.** Lycopodiinae (Homosporous). Two genera (*Psilotum*, *Tmesipteris*) with 3 sp. trop. and subtrop. The mature sporophyte has no roots, their functions being performed by the branched rhizomes. The aerial branches bear only scale-leaves in *Psilotum*. The



sporangia are 2- or 3-loc., borne on small two-lobed sporophylls. "There has been much disagreement as to the morphological nature of the sporangiophores of the Psilotaceae. The two chief views are the following: (1) that the whole sporangiophore is a single foliar member; (2) that it is a reduced axis bearing a terminal synangium and two leaves. The recent very careful researches of Bower upon the origin of the sporangiophore and synangium confirm the former view" (Campbell; see also Bower in *Phil. Trans.* CLXXXV, 1894, p. 473).

"The fully-developed synangium (2-loc. in *Tmesipteris*, 3-loc. in *Psilotum*) has the outer walls of the loculi composed of a superficial layer of large cells, beneath which are several layers of smaller ones. The cells composing the septa are narrow tabular ones; occasionally the septum is partially absent.... Bower regards the whole synangium as homologous with the single sporangium of *Lycopodium*" (Campbell). The prothallus has not been seen.

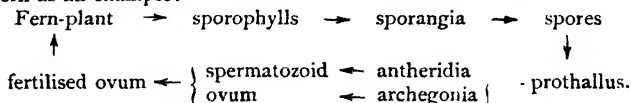
**Psilotum** Sw. Psilotaceae. 2 sp. trop. They are probably saprophytic in their habit, and have neither roots nor green leaves, but only green stems. See order for details of sporangia &c. Vegetative reproduction is common, small gemmae being formed upon the rhizomes. At first no structural differentiation is visible in these, but apical cells are formed later.

**Psoralea** Linn. Leguminosae (III. 6). 100 sp. Afr., As., Austr. *P. esculenta* Pursh (N. Am.) is the prairie turnip, with an edible tuberous root.

**Psychotria** Linn. (excl. *Mapourea* Aubl.). Rubiaceae (II. 15). 360 sp. trop. Some are heterostyled. Many have the infl.-axis brightly coloured. See Cephaelis. [For *P. Ipecacuanha* Stokes see Uragoga.]

**Ptelea** Linn. Rutaceae (IX). 7 sp. N. Am. *P. trifoliata* L. is often grown in parks (shrubby trefoil). Flrs. monœcious. Fruit winged (cf. *Ulmus*).

**Pteridophyta.** Vascular Cryptogams, one of the four chief divisions of the Vegetable Kingdom. They have a well marked alternation of generations, the oöphyte (gametophyte or sexual generation) being insignificant in size compared to the sporophyte (asexual generation), but still capable of independent growth. The life history of a typical Pteridophyte may be shown diagrammatically as follows, taking the fern as an example:



The 'plant' or asexual generation alternates with the prothallus or sexual generation. In many P. there are male and female prothalli. The prothallus corresponds to the 'plant' in a moss or liverwort,

whilst the sporogonium of these latter is the equivalent of the 'plant' in a fern or lycopod.

The plant itself takes various forms in the different groups. Except in the tree ferns and in fossil forms it does not attain any great size. There is an erect stem in many ferns &c.; others have creeping stems (e.g. *Lycopodium* and *Selaginella*), rhizomes (many Ferns), or floating stems (*Hydropterideae*). The leaves are simple, except in many ferns. There is no primary tap-root, but roots are formed as required from the stem or leaves. Internally there are well marked vascular bundles in both stem and leaf, and most of the anatomical features of *Phanerogams* may be found here also.

The sporangia arise upon the leaves, either on the ordinary foliage as in most ferns, or on specially metamorphosed leaves as in *Osmunda*, *Equisetum*, *Lycopodiaceae*, *Hydropterideae*, &c. They may be solitary or in groups (*sori*); in the latter case they are often protected by a special outgrowth of the leaf, the *indusium*. The spores are formed by a complicated process from a single cell or row or layer of cells—the *archesporium*—inside the sporangium: each has a thick waterproof outside wall. The spores may be of one kind only, in which case the plant is termed *homo-* or *iso-sporous*, or of two kinds (*heterosporous*). In this case the smaller spore is termed the *microspore*, the larger the *mega-* or *macro-spore*; the former gives rise to a male prothallus, the latter to a female.

Falling upon the soil (or into the water, in the case of the *Hydropterideae*) the spores germinate under suitable conditions, giving rise to the *sexual* plants or *prothalli*. The prothallus is a small body without distinction into stem and leaf; it absorbs materials from the soil (usually by rhizoids) and, being green, assimilates in the ordinary way. It bears the sexual organs—*antheridia* (male) and *archegonia* (female). In the homosporous forms these are both found on the same prothallus, except in *Equisetum*, where, though the spores are absolutely similar so far as we can tell, there are separate male and female prothalli, as in the heterosporous forms. In the antheridia are developed the motile male cells or *antherozoids* (often called *spermatozoids* as they are equivalent to the spermatozoa of animals). Fertilisation takes place by aid of water. The mucilage contained in the neck of the archegonium is attractive to the spermatozoids (p. 43), which swim up the neck of the archegonium. One of them finally fuses with the *ovum* or female cell at the base of the archegonium, and the fertilised ovum (*zygote*) then develops into a new 'plant' or asexual generation, being nourished by the prothallus until it can assimilate for itself.

#### Classification:

- I. *Filicineae*: Mostly homosporous, with monœcious prothalli (*Hydropterideae* are heterosporous, with dioecious prothalli). Stem with few or no branches; leaves usually large and

branched. Sporangia numerous, on ordinary or on metamorphosed leaves, commonly collected into sori. See F. for further classification.

- II. *Equisetineae*: Homosporous (some fossil forms are heterosporous), with dioecious prothalli. Stem much branched with jointed internodes and small sheathing whorls of leaves (not green). Sporangia on peltate sporangiophores, forming a terminal spike.

[III. *Sphenophylleae*: fossil plants only.]

- IV. *Lycopodineae*: Homosporous or heterosporous; in the latter case the female prothallus remains enclosed in the spore till fertilisation. Stem simple or branched; leaves many, small, entire. Sporangia singly on upper side of leaf-bases, or in their axils, or sunk in the end of a short branch.

**Pteridium** Gleditsch = *Pteris* Linn.

**Pteris** Linn. Polypodiaceae. 100 sp. cosmop. *P. aquilina* L. the bracken, is best known, and is common in Brit. It has a creeping rhizome, bearing two ranks of leaves. At the base of the leaf is a nectary whose use is unknown; ants may be seen visiting it. The sori are confluent along the leaf-margin which is curved over them. The bracken is sometimes placed in a genus *Pteridium* distinct from all the other sp. on account of its having a true indusium on the inner side of the sorus, in addition to the 'false' indusium formed by the curving over of the leaf blade. Adventitious buds appear on the back of the leaf stalk, near the base (cf. *Aspidium*). Apogamy occurs in *P. cretica* L. (see Filicineae Leptosporangiateae).

**Pterocarpus** Linn. Leguminosae (III. 8). 20 sp. trop. Several sp., esp. *P. Marsupium* Roxb., furnish Kino, an astringent resin. *P. santalinus* L. f. yields red sandal-wood. The fruit is winged.

**Pterocarya** Kunth. Juglandaceae. 4 sp. N. temp.

**Pterocephalus** Vaill. = *Scabiosa* Tourn.

**Pteronia** Linn. Compositae (III). 52 sp. S. Afr.

**Pterostylis** R. Br. Orchidaceae (4). 40 sp. Austr., N. Z., New Caled.

The median sepal, with the petals, forms a hood over the rest of the flr. The flap of the labellum hangs out below and is irritable. If an insect land on it, it instantly moves up and imprisons the visitor against the column; the only mode of escape is by squeezing past the stigma and anther. After half-an-hour the lip goes down again and is ready for another capture (Darwin, *Orchids*, p. 86).

**Ptychosperma** Labill. Palmae (IV. 6). 15 sp. Indo-mal. Flrs. in threes, 2 ♂ and 1 ♀. *P. (Seaforthia) elegans* Blume is a favourite ornamental palm.

**Pugionium** Gaertn. Cruciferae (IV. 18). 2 sp. Mongolia.

**Pulicaria** Gaertn. Compositae (IV). 30 sp. Eur., As., Afr. *P. dysenterica* Gaertn. (*Inula dysenterica* L.) in Brit. (flea-bane).

**Pulmonaria** (Tourn.) Linn. Boraginaceae (IV. 3). 10 sp. Eur. *P.*

*officinalis* L. (lung-wort, formerly officinal) and *P. angustifolia* L. in Brit. Both have dimorphic heterostyled flrs. which change from red to blue as they grow older (see order).

**Pulsatilla** (Tourn.) Linn. = *Anemone* Tourn.

**Pultenaea** Sm. Leguminosae (III. 2). 76 sp. Austr.

**Punica** (Tourn.) Linn. The only genus of Punicaceae. 2 sp., one in Socotra, the other, *P. Granatum* L., the pomegranate, from the Balkans to the Himalayas, and cultivated in most trop. lands. The young twigs of the tree have four wings, composed simply of epidermis and cortical parenchyma; these are early thrown off. The flr. is ♀, regular, perigynous. K 5--8, valvate; C 5--8, imbricate. Sta. ∞. Ovary adnate to receptacle. The mature ovary has a peculiar structure, due to a development like that in *Mesembryanthemum*. Two whorls of cpls. with basal placentae are laid down, and then a peripheral growth tilts them up from  $\parallel \cdot \parallel$  to  $= \cdot =$  so that two layers of loculi are formed and the placentation appears to be parietal. Ovules ∞, anatropous. The arrangement is also seen in the fruit, commonly termed a berry, but not strictly so. The pericarp (axial in part) is leathery, and the fleshy inner part round the seeds is really the outer layers of the seed coats.

**Punicaceae.** Dicotyledons (Archichl. Myrtiflorae). Only genus *Punica* (q.v.). Placed in Lythraceae by Benth.-Hooker and in Myrtaceae by Warming.

**Pupalia** Juss. Amarantaceae (2). 5 sp. Afr., As.

**Purshia** DC. Rosaceae (III. 7). 1 sp. West U.S.

**Pusaetha** Linn. = *Entada* Adans.

**Puschkinia** Adams. Liliaceae (v). 2 sp. W. As.

**Pycnanthemum** Michx. Labiatae (vi. 11). 13 sp. N. Am.

**Pyrethrum** Hall. = *Chrysanthemum* Tourn.

**Pyrola** (Tourn.) Linn. (incl. *Moneses* Salisb.). Pyrolaceae. 15 sp. N. Temp. (5 Brit. wintergreen). Evergreens with creeping stocks. *P. (Moneses) uniflora* L. has adventitious buds on the roots, and a solitary terminal flower. *P. minor* L. is the most frequent in Brit. The flrs. are in racemes, pendulous, without discs. There is no honey; the stigma projects beyond the anthers, but pollen may at last fall upon it from them. *P. rotundifolia* L. is similar. The seeds of *P.* are very light and are distributed by wind. Many sp. prefer shady places.

**Pyrolaceae.** Dicotyledons (Sympet. Ericales). 10 gen. with 30 sp., cold N. temp. and arctic. The two Brit. genera represent the two types of habit found in the order—evergreen plants with sympodial growth from rhizomes (*Pyrola*), and saprophytes (*Monotropa*). The infl. is terminal; it may be a true raceme (*Pyrola*), or a cyme, leafless or with scaly bracts. Flr. ♀ actinomorphic. K 4--5; C (4--5) or 4--5; A 8--10, obdiplostemonous; G (4--5). The petals and sta. are often at the edge of a nectariferous disc. Anthers introrse, opening by apical pores or transverse valves; pollen simple or in tetrads.

Cpls. opp. petals; ovary imperfectly 4—5-loc. Style simple. Ovules minute,  $\infty$ , anatropous, on thick fleshy placentae. Fruit a capsule. Seeds  $\infty$ , small, in loose testa. Embryo of few cells, without differentiation of cotyledons. *Chief genera*: *Pyrola*, *Chimaphila*, *Monotropa*, *Sarcodes*. Benth.-Hooker united *Pyrola* and the similar green-leaved forms to *Ericaceae*, making an order *Monotropeae* for the Saprophytes; they place both in *Ericales*; they are placed in *Bicornes* by Warming.

**Pyrus** (Tourn.) Linn. (incl. *Cydonia* Tourn., *Mespilus* Tourn.). *Rosaceae* (II. 4). 50 or 60 sp. N. temp.; 6 in Brit., incl. *P. Aucuparia* Ehrh., the rowan or mountain ash, *P. Malus* L. the apple, &c. The receptacle is hollowed out and united to the syncarpous ovary. The flrs. are protogynous, and are visited by bees and many other insects. Several varieties of pear (*P. communis* L.) are self-sterile (see Waite in *Bull. U.S. Agric. Dept.* 1894). After fertilisation the fruit becomes a large fleshy pseudocarp (*pome*), the flesh consisting of the enlarged receptacle, while the gynœceum forms the core. Several sp. are cultivated for their fruit, e.g. *P. Malus* L. (apple), *P. communis* L. (pear), *P. Cydonia* L. (quince), *P. germanica* Hook. f. (medlar). *P. japonica* Thunb. is often grown upon walls.

**Quamoclit** Tourn. ex Moench = *Ipomœa* Linn.

**Quercus** (Tourn.) Linn. (incl. *Pasania* Oerst.). *Fagaceae*. 300 sp. N. temp., Indo-mal., Pacific coasts, &c. The oaks are evergreen or deciduous trees, in the latter case especially with well-developed winter buds. The cupule contains 1 ♀ flr. only (see order), and forms the acorn-cup at the base of the nut in fruit. Some sp. of the subgenus *Pasania* have 3 ♀ flrs. The ♂ flrs. are solitary in pendulous catkins. Anemophilous. Many sp. are important economic plants. Among the most noteworthy are: *Q. Aegilops* L. (E. Eur., Orient), whose cupules and unripe acorns, known as Valonia, are used in tanning, *Q. alba* L. (N. Am.), the white or Quebec oak (timber), *Q. Cerris* L. (Eur., Orient), the Turkey oak (timber), *Q. Ilex* L. (Medit.), the holly oak (timber, bark for tanning), *Q. Robur* L. (Eur., W. As.), the British oak (it has two forms, *sessiliflora* Salisb., and *pedunculata* Ehrh.), yielding timber and tan-bark, *Q. Suber* L. (Medit.) the cork oak, whose bark, stripped off in thick layers and flattened, forms ordinary cork, *Q. tinctoria* Bartr. (N. Am.), whose bark (*Quercitron* bark) forms a yellow dye, and many others.

**Quina** Aubl. *Quinaceae*. 16 sp. trop. S. Am.

**Quinaceae**. Dicotyledons (Archichl. Parietales). 2 gen. with 19 sp. trop. S. Am. Placed in *Guttiferae* by Benth.-Hooker.

**Quillaja** Molina. *Rosaceae* (I. 2). 3 sp. S. Am. *Q. Saponaria* Molina is the soap-tree of Chili; the powdered bark gives a lather with water.

**Quinaria** Rafn. = *Vitis* Tourn.

**Quisqualis** Linn. *Combretaceae*. 4 sp. trop. Afr., As. *Q. indica* L. is best known. "Up to a height of 1 m. this shrub grows erect with

alt. leaves, and then emits long...often twining twigs, also with alt. leaves whose petiole is jointed some way from the base. After the leaf-fall the lower part forms a thorn. The flowering twigs have opp. leaves." (Brandis.) Fruit winged.

**Radiola** (Dill.) Roth. Linaceae. 1 sp. Eur. (incl. Brit.), N. Afr., temp. As., *R. linoides* Roth (all-seed). Infl. a dichasial cyme.

**Rafflesia** R. Br. Rafflesiaceae. 5 sp. Java, Sumatra, &c.; parasitic on *Vitis* roots. *R. Arnoldi* R. Br. has a colossal flr. a yard across and weighing 15 lbs. It smells like putrid meat, and is visited and pollinated by carrion flies (p. 103).

**Rafflesiaceae.** Dicotyledons (Archichl. Aristolochiales). 7 gen. with 22 sp. trop. An extremely interesting order of parasitic herbs, whose vegetative organs are reduced to what is practically a *mycelium* like that of a true Fungus, viz. a network of fine cellular threads ramifying in the tissues of the host (p. 194). The flrs. appear above ground, developing as adventitious shoots upon the mycelium. They are unisexual, and sometimes of enormous size. Chief genera: *Rafflesia*, *Brugmansia*, *Pilostyles*, *Cytinus*. Benth.-Hooker term the order *Cytinaceae*, and include in it the *Hydnoraceae*, placing the whole in *Multivolutae Terrestres*, Warming places it in *Hysterophyta*.

**Rafnia** Thunb. Leguminosae (III. 3). 22 sp. S. Afr.

**Ramondia** Rich. Gesneriaceae (I). 4 sp. endemic on Mts. of S. Eur. (1 Pyrenees, 1 Olympus, 2 Servia; see p. 159). Flr. almost regular with 5 sta. and rotate corolla.

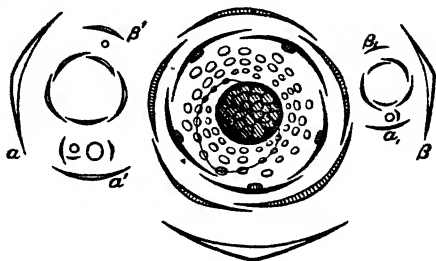
**Ranales.** The 11th cohort (Engler) of Archichlamydeae (p. 137). The first cohort (Benth.-Hooker) of Polypetalae (p. 141).

**Randia** Houst. ex Linn. Rubiaceae (I. 8). 100 sp. trop. The two leaves at a node are often unequal (p. 38) and one frequently aborts early. Thorns often occur. In *R. dumetorum* Lam. the thorn arises in the axil of a leaf above the ordinary bud, and is carried up by intercalary growth.

**Ranunculaceae.** Dicotyledons (Archichl. Ranales). 27 gen. with 700 sp., chiefly N. temp. and well represented in Brit. Most are herbaceous perennials with rhizomes, usually of condensed (root-stock) form, and always of sympodial construction. Each year's shoot ends in an infl. and a bud is formed in the axil of one of the leaves at the base, which forms the next year's growth. In most sp. the primary root soon dies away, and adventitious roots are formed from the stem; often (e.g. *Aconitum*, *Ranunculus* sp.) these swell up into tubers holding reserve materials. The leaves are usually alt., with sheathing bases and often very much divided. The chief exceptions to the above general statements, and special cases of interest, are described under the genera, e.g. *Helleborus*, *Eranthis*, *Clematis*, *Ranunculus*.

The infl. is typically determinate; in *Anemone* sp., *Eranthis*, &c., a single terminal flr. is produced. More often a cymose branching occurs, the buds in the axils of the leaves below the terminal flr.

developing in descending order. In *Nigella* sp. and others, after the terminal flr. is formed, the buds below develop in ascending order, so that a raceme with an end flr. is formed; in *Aconitum* &c. the same thing occurs, but the terminal flr. rarely develops. In *Nigella*,



*Ranunculus acris*. Floral diagram of axillary dichasial cyme, with details of primary flr. Sta. according to the  $\frac{8}{1}$  phylotaxy.  $\alpha$   $\beta$  bracteoles of primary,  $\alpha'$   $\beta'$ ,  $\alpha$ ,  $\beta$ , of later, flrs. After Eichler.

*Anemone*, &c., there is an involucre of green leaves below the flr., usually alternating with the calyx.

The flr. itself is typically spiral upon a more or less elongated receptacle, but frequently the leaves of the perianth are in whorls. It is usually regular and  $\frac{8}{1}$ . The perianth is usually petaloid and rarely (e.g. *Ranunculus*) shows a true calyx and corolla. Frequently there occur nectaries of various patterns between the perianth proper and the sta.; these are usually considered as modified petals, but it is as probable that they are derived directly from sta. without having passed through the petal stage. An interesting series of transitions may be seen by comparing the following flrs.:—*Caltha* (honey secreted by cpls., 'calyx' present, nothing between it and sta.), *Helleborus* or *Eranthis* (honey secreted in little tubular 'petals'), *Nigella* (ditto, but 'petals' with a small leafy end), *Ranunculus auricomus* ('petals' distinct and coloured, with pocket-like nectary at base), *R. acris* &c. (petals large, nectary at base). In *Aconitum* and *Delphinium* there is a zygomorphic flr. The sta. are usually  $\infty$  and spiral, the anthers extrorse; the cpls.  $\infty$ , apocarpous, spiral, with either one basal or several ventral anatropous ovules. In *Nigella* the cpls. are united; there is only 1 in *Actaea*, which thus forms a link to *Berberidaceae*.

As a rule the flrs. are protandrous and the sta., as their anthers open, bend outwards from the centre of the flr. A good series of flrs. showing various grades of adaptation to insects may be found in *R.* (cf. pp. 64 seq.), e.g. *Clematis* (pollen flr.), *Ranunculus* (actinomorphic, honey scarcely concealed at all), *Nigella* (honey in little closed cavities), *Aquilegia* (honey in long spurs), *Delphinium* (ditto, but zygomorphic also, and blue in colour), &c.

The fruit is a group of achenes or follicles (capsule in *Nigella*, berry in *Actaea*); seeds with minute embryo and oily endosperm. The *R.* are mostly poisonous; a few, *e.g.* *Aconitum*, are or have been medicinal.

*Classification and chief genera* (after Prantl):

A. Ovules many; fruit a follicle, berry or capsule.

1. *Paeoniaceae* (no honey leaves; flrs. usually solitary; ovary wall fleshy; stigma broadened): *Paeonia*.

2. *Helleboreae* (usually honey-leaves; ovary wall rarely fleshy and then flrs. in racemes; flrs. solitary or in cymes or racemes): *Caltha*, *Trollius*, *Helleborus*, *Nigella*, *Eranthis*, *Actaea*, *Aquilegia*, *Delphinium*, *Aconitum*.

B. Ovule one; fruit an achene.

3. *Anemoneae*: *Anemone*, *Clematis*, *Ranunculus*, *Thalictrum*.

[Placed in Ranales by Benth.-Hooker, in Polycarpiceae by Warming.]

**Ranunculus** (Tourn.) Linn. Ranunculaceae (3). 250 sp. cosmop., esp. N. temp.; 15 in Brit., several of interest. *R. Ficaria* L. (pilewort or celandine) has tuberous roots, one formed at the base of each axillary bud; these may give rise by separation to new plants. *R. aquatilis* L. (water crowfoot) is often divided into a large number of so-called species (see pp. 126, 169); it has a floating stem bearing leaves which in many forms are of two kinds (*heterophylly*, p. 173), the submerged leaves being much divided into linear segments, whilst the floating leaves are merely lobed. *R. repens* L. (creeping buttercup or crowfoot) has creeping runners (p. 164) which root at the nodes and give rise to new plants. *R. acris* L. and *R. bulbosus* L. are other common buttercups; the latter has the base of the stem thickened for storage. The flrs. of *R.* are in cymes, regular, with well-marked calyx and corolla (see order for diagram). Honey is secreted in little pockets at the base of the petals. The flrs. are protandrous and visited by a miscellaneous lot of insects (p. 65).

**Raoulia** Hook. f. Compositae (IV). 18 sp. N. Z., Austr. Woolly herbs forming dense tufted masses (p. 180), easily mistaken at a distance for sheep; hence they are known as 'vegetable sheep.'

**Rapatea** Aubl. Rapateaceae. 5 sp. S. Am.

**Rapateaceae**. Monocotyledons (Farinosae). 6 gen. with 25 sp. S. Am. Placed in Coronarieae by Benth.-Hooker, in Liliiflorae by Warming. For details see *Nat. Pfl.*

**Raphanus** (Tourn.) Linn. Cruciferae (II. 10). 10 sp. Medit., Eur., Java. *R. Raphanistrum* L. in Brit.; its pods are jointed between the seeds (lomentose). *R. sativus* L. is the radish, a biennial with root-storage (p. 161).

**Raphia** Beauv. Palmae (III. 5). 6 sp. trop. Afr., *R. vinifera* Beauv. (the wine palm) occurring also on the Amazon (see order). Spadix monœcious; the bracts have a curious sheathing form. Berry



enclosed in large sheathing scales. In *R. Ruffia* Mart. roots are developed between the dead leaf-bases; they curve upwards and are said to act as respiratory organs.

**Ratonia** DC. (*Matayba* Aubl.). Sapindaceae (I). 36 sp. trop. and subtrop. Am.

**Ravenala** Adans. Musaceae. 2 sp. Madag. and S. Am. They have a true sub-aerial stem, which bears large leaves in 2-ranked phyllotaxy, giving the plant a peculiar fan-like appearance. *R. guyanensis* Steud. is the only Am. sp. of the suborder *Museae*. *R. madagascariensis* J. F. Gmel. is the traveller's tree, so-called because the water that accumulates in the leaf-bases has been used for drinking in cases of necessity.

**Reaumuria** Linn. Tamaricaceae. 13 sp. E. Medit., Cent. As. Halophytes (p. 187). [See Volkens *Flora d. aegyptisch-arabische Wüste*.]

**Reineckia** Kunth. Liliaceae (VII). 1 sp. China, Japan.

**Reinwardtia** Dum. Linaceae. 1 sp. N. India.

**Relbunium** L'Hérit. Compositae (IV). 18 sp. S. Afr.

**Remusatia** Schott. Araceae (VI). 2 sp. E. Ind., Java. *R. vivipara* Schott has a tuberous stem which gives off upright shoots bearing scale-leaves: in their axils are little tubers, each of which is provided with a terminal hook by which it may be carried away by an animal.

**Renanthera** Lour. Orchidaceae (31). 12 sp. Malaya, Cochin China. Climbers.

**Reineckia** Linn. f. Zingiberaceae. 15 sp. trop. Am., W. Afr.

**Reseda** Tourn. ex Linn. Resedaceae. 53 sp. Medit., Eur.; *R. lutea* L. and *R. luteola* L. in Brit. *R. odorata* L. is the garden mignonette. There is a large posterior disc. The ovary and fruit are open at the apex. *R. lutea* is the dyer's weld; it yields a yellow dye.

**Resedaceae**. Dicotyledons (Archichl. Rhoeadales). 6 gen. with 45 sp. chiefly Medit., also in Eur., As., S. Afr., Calif. Most are xerophytic herbs with alt. stip. leaves and racemes of zygomorphic  $\frac{4}{5}$  fls., with bracts but without bracteoles. The axis develops posteriorly into a large disc, and upon this side the petals &c. are usually better developed than upon the anterior side of the flr.  $K\ 4-8$ ;  $C\ 0-8$ ;  $A\ 3-40$ ;  $G\ (2-6)$  or  $2-6$ , in the former case 1-loc. with parietal placentae. Ovary open at the top; ovules  $1-\infty$  per cpl., anatropous. Fruit capsular; embryo curved; no endosperm. *Chief genera*: Reseda, Oligomeris. Placed in Parietales by Benth.-Hooker, in Cistiflorae by Warming.

**Restiaceae** (Benth.-Hooker) = Restionaceae.

**Restio** Linn. Restionaceae. 100 sp. S. Afr., Austr. *R. tetraphyllus* Labill. is often grown in botanic gardens. Assimilation is performed by the green stems, the leaves being reduced to sheaths.

**Restionaceae**. Monocotyledons (Farinosae). 19 gen. with about 250 sp., mostly in S. Afr. and Austr., a few in N. Z., Chili and Cochin China. Xerophytes (p. 178), usually of tufted growth, with the general

habit of a *Juncus*; below ground is a rhizome with scaly leaves, giving off erect cylindrical shoots bearing sheathing leaves (rarely with ligules), which have a short blade, or sometimes none at all, in which case assimilation is performed by the stem. Flrs. diœcious (rarely monoœcious or ♀), regular, in spikelets. Perianth in two whorls, but single members are often absent. Sta. 3 or 2, opp. to the inner perianth-leaves. Ovary superior, 1—3-loc., with 1 pendulous orthotropous ovule in each loc. Capsule or nut. Embryo lens-shaped, in mealy endosperm. *Chief genus*: *Restio*. Placed in *Glumaceae* by Benth.-Hooker, in *Enantioblastae* by Warming. See *Nat. Pfl.* for further details.

**Restrepia** H. B. et K. *Orchidaceae* (12). 12 sp. trop. Am.

**Retinispora** Sieb. et Zucc. = *Thuya* Linn., &c. Seedlings of many sp. of the genera *Chamaecyparis*, *Cupressus*, *Thuya*, &c., exhibit, instead of the decussate appressed leaves of the mature plant, spreading needle-leaves (often in whorls of 4) like those of *Abies* &c. (see p. 113 and cf. *Pinus*, *Acacia*, &c.). If now these young seedlings be used as offsets, the new plants thus formed retain throughout life this form of foliage; and plants are thus obtained of totally different habit from the ordinary habit of these genera. To these 'seedling forms' the name *R.* was given. Many are found in gardens. The synonymy of the chief of these is as follows: *R. decussata* hort. = *Thuya orientalis*; *R. filifera* Fowles = *Cupressus obtusa*; *R. juniperoides* Carr. = *Thuya orientalis*; *R. obtusa* Sieb. et Zucc. = *Cupressus obtusa*; *R. pisifera* Sieb. et Zucc. = *Cupressus pisifera*; *R. recurvata* hort. and *R. rigida* Carr. = *Thuya orientalis*; *R. squarrosa* Sieb. et Zucc. and *R. stricta* hort. = *Cupressus pisifera*. For further synonymy see *Index Kewensis*.

**Rhagadiolus** Tourn. ex Scop. (incl. *Hedynois* Schreb. and *Garhadiolus* Jaub. et Spach). *Compositae* (XIII). 8 sp. *Medit.*, *Orient.* The fruit is linear and has no pappus, being completely enwrapped in an involucre bract.

**Rhamnaceae**. *Dicotyledons* (*Archichl. Rhamnales*). About 40 gen. with 500 sp., found in all districts suited to the growth of trees. Nearly all are trees or shrubs, often climbing (by aid of hooks in *Ventilago*, tendrils in *Gouania* &c., twining stems in *Berchemia*): thorns occur in some, and especially in *Colletia* and its allies, to which a most peculiar habit is thereby imparted. In these plants too, serial buds occur in the leaf-axils. Leaves simple, usually with stipules, never lobed or divided. Infl. cymose, usually a corymb.

Flr. inconspicuous, ♀ or rarely unisexual, regular, sometimes apetalous. Receptacle hollow, free from or united to the ovary. K 5—4, valvate; C 5—4, usually small, often strongly concave, frequently clawed at base. Sta. 5—4, alt. with sepals, usually enclosed by the petals, at any rate at first. Disc usually well developed, intra-staminal. Ovary free or more or less united to receptacle, 3—2- (rarely by abortion 1-) loc. (sometimes 4- or typically 1-loc.); in each loc. 1

(rarely 2) basal ovule with downwardly-directed micropyle Style simple or divided Fruit dry, splitting into dehiscent or indehiscent mericarps, or a drupe with 1 or several stones, or a nut Endosperm little or none Many of the dry fruits show special adaptations for wind carriage, e.g. *Paliurus*, *Ventilago* The order is closely related to Vitaceae, from which it is chiefly distinguished by the small petals, the receptacle, the endocarp and simple leaves, it also approaches Celastraceae, the chief distinction being the antepetalous stamens Chief genera *Ventilago*, *Paliurus*, *Zizyphus*, *Rhamnus*, *Hovenia*, *Ceanothus*, *Phyllica*, *Colletia*, *Gouania* Few are of economic value, see *Zizyphus*, *Rhamnus*, *Hovenia* Benth Hooker place the order in Celastrales, Warming in Frangulinae

**Rhamnales** The 17th cohort of Archichlamydeae (p. 138)

**Rhamnaceae** (Benth Hooker) = Rhamnaceae

**Rhamnus** Tourn. ex Linn. Rhamnaceae 70 sp. N. temp., a few trop. and S. temp., 2 in Brit., *R. cathartica* L. the common or purging buckthorn, and *R. Frangula* L., the Alder buckthorn. The R. are shrubs with alt. or opp. leaves and small cymose clusters of fls. The genus is divided into two sections. To § 1, *Eurhamnus* (fls. usually 4 merous, polygamous or dioecious), belong *R. Alaternus* L. (Medit.) and *R. cathartica* (Eur., As., Medit.) whose berries possess active purgative properties, the juice of the fruit is mixed with alum and evaporated, thus forming the paint known as sap green, also *R. infectoria* L. (Mts. of S. Eur.) whose berries are known as Graines d'Avignon or 'yellow berries' and yield useful green and yellow dye stuffs, and *R. chlorophora* Dcne. from whose bark the Chinese prepare the dye known as 'Chinese green indigo' used in dyeing silk (*R. utilis* Dcne. is also employed). To § 2, *Frangula* (fls. usually 5 merous, ♀), belong *R. Frangula* (Eur., As., N. Afr.) whose bark is officinal (cathartic) and whose wood forms one of the best charcoals for gunpowder, *R. Purshiana* DC. in N. Am., whose bark (Casearia sagrada) is largely used as a cathartic.

**Rhaphidophora** Hassk. Araceae (II) 25 sp. E. Ind. Plants with sympodial climbing stems with clasping roots and pendulous aerial roots. The pinnation of the leaves arises by a process similar to that which occurs in *Monstera*, i.e. by long holes arising between the ribs, and the margin finally breaking. Fls. ♀.

**Rhapis** Linn. f. Palmae (I 2) 5 sp. E. As.

**Rheum** Linn. Polygonaceae (I 2) 20 sp. temp. and subtrop. As. The fls. are like those of *Rumex*, but are coloured and entomophilous, though they exhibit traces of anemophilous nature in their very large stigmas (cf. *Poterium* &c.) *R. officinale* Baill. furnishes medicinal rhubarb; *R. Rhaponticum* L. is the rhubarb used as a vegetable.

**Rhexia** Linn. Melastomaceae (I). 7 sp. East U.S.

**Rhinanthus** Linn. (incl. *Fistularia* Linn.). Scrophulariaceae (III. 12).

11 sp. Eur., Medit.; 2 in Brit. (yellow-rattle), common in damp pastures. Semi-parasites with loose pollen flrs. (see order).

**Rhipsalis** Gaertn. Cactaceae (I. 3). 50 sp. trop. Am., Madag., Ceylon (see order). Epiphytes, rarely thorny, sometimes of *Cereus*-like structure, sometimes *Phyllocactus*-like, or with cylindrical stems (compare sp. of *Euphorbia*). Fruit fleshy.

**Rhizoboleae** = Caryocaraceae.

**Rhizophora** Linn. Rhizophoraceae. 3 sp., *R. Mangle* L. in Am., *R. mucronata* Lam. and another, Japan to E. Afr. These mangroves (p. 188) are moderate-sized trees with a great development of roots from the stem and branches. On the sub-aerial parts of the roots are large lenticels, probably serving in the same way as the aerenchyma of *Bruguiera* &c. The seed germinates upon the tree, the hypocotyl projects at the micropyle and grows rapidly. The bark is used for tanning, yielding a substance known as cutch (cf. *Acacia*).

**Rhizophoraceae**. Dicotyledons (Archichl. Myrtiflorae). 12 gen. with 50 sp. trop., mostly Old World. The general habit of the mangroves is described on p. 188. They are trees with opp. stip. leaves; flrs. solitary or in cymes &c., ♀, hypo- to epi-gynous. K usually 4—8; C 4—8; A 8—∞, inserted on outer edge of perigynous or epigynous disc; G (2—5), 2—5-loc. with usually 2 anatropous pendulous ovules in each loc. Fruit a slightly soft berry. *Chief genera*: *Rhizophora*, *Bruguiera*. Placed in Myrtales by Benth.-Hooker, in Myrtiflorae by Warming.

**Rhodea** Endl. = *Rohdea* Roth.

**Rhodochiton** Zucc. Scrophulariaceae (II. 5). 1 sp. Mexico, *R. volubile* Zucc., a favourite greenhouse twiner with sensitive petioles (cf. *Clematis*).

**Rhododendron** Linn. (incl. *Azalea* Linn., q.v.). Ericaceae (I. 2). 200 sp. "One sp. (*R. Lochae* F. Muell.) is found in trop. Austral., the greatest richness of sp. is in E. Asia, from S. China to the Himalaya and Japan; a second and lesser abundance is found in temp. N. Am., and a few sp. in the arctic regions. 4 sp. in Mid. and S. Eur., 5 in Caucasus. The alpine sp. are called 'alpine roses.'" (Drude.) Many sp. and hybrids are cultivated. They are shrubs and small trees with leathery leaves; the leaves of § *Azalea* last one year, those of the other subgenera usually more. Large winter buds are formed covered with scale leaves; the larger and stouter ones contain infls., the slender ones merely leaves. The branch bearing an infl. is continued by the formation of a bud in one of the upper leaf axils. Some of the Indian sp. are epiphytic. The corolla is slightly zygomorphic, and the sta. and style bend upwards to touch the under surface of a visiting insect. *R. ferrugineum* L., the alpine rose, is protandrous and visited by humble-bees.

**Rhodotypos** Sieb. et Zucc. Rosaceae (III. 5). *R. kerrioides* S. et Z., the only sp. (Japan), is a favourite garden shrub. It has opp. leaves,

found in no other plant of the order, except in seedlings of *Prunus*. There is an epicalyx (see *Potentilla*).

**Rhoecadales.** The 12th cohort of Archichlamydeae (p. 137).

**Rhoecadinae** (Warming). The 9th cohort of Choripetalae (p. 146).

**Rhus** (Tourn.) Linn. (incl. *Cotinus* Tourn. and *Toxicodendron* Tourn.). Anacardiaceae (111). 120 sp. subtrop. and warm temp. *R. Coriaria* L. is the Sumac (S. Eur.); its leaves, ground fine, are used for tanning and dyeing. *R. Toxicodendron* L. (N. Am.) is the poison-ivy, climbing with roots like ivy. Its juice produces ulcerations or erysipelas. *R. Cotinus* L. (Medit. to China) is the wig-tree, often cultivated in shrubberies. The flrs. are polygamous. The fruits are dispersed in a curious way. The stalk of each drupe remains smooth, but the sterile parts of the panicle lengthen and become very hairy. Then when ripe the stalks become detached at their joints, and the whole infl., with the fruits on it, falls to the ground and may be blown about by the wind, it being exceedingly light in proportion to its size. The wood yields the yellow dye known as 'young fustic.' *R. vernicifera* DC. is the lacquer-tree. Japan lacquer is obtained from notches in the stem. *R. succedanea* L. is the wax-tree of Japan; its crushed berries yield wax.

**Rhynchospora** Willd. = *Rynchospora* Vahl.

**Ribes** Linn. Saxifragaceae (VI). 50 sp. N. temp. and Andine; 4 in Brit. Shrubs, often with spines (emergences), and with racemes of flrs. on 'short shoots.' Ovary inferior, with two parietal placentae. Flrs. usually homogamous, with self-pollination in default of insect-visits. *R. alpinum* L. is dioecious. In *R. sanguineum* Pursh (common in shrubberies, and known as flowering currant) the petals change from white to pink as the flrs. grow older, and in *R. aureum* Pursh from yellow to carmine (see *Fumaria*, Boraginaceae). *R. rubrum* L. is the red, *R. nigrum* L. the black currant, *R. Grossularia* L. the gooseberry, all largely cultivated for their fruits.

**Richardia** Kunth. (*Zantedeschia* Spreng.). Araceae (V). 6 sp. S. Afr., including *R. africana* Kunth, the common 'Arum lily' of green-houses.

**Richea** R. Br. Epacridaceae. 8 sp. Tasmania, Victoria.

**Ricinus** (Tourn.) Linn. Euphorbiaceae (A. II. 1). 1 sp. Afr., *R. communis* L. the castor-oil plant, a shrub in tropical countries, a herbaceous plant in our gardens. Monoecious. The ♂ flr. has much-branched sta. The fruit explodes into the separate cpls., which at the same time open and drop the seeds. The seed is rich in oil, which is used medicinally and as a lubricant.

**Rindera** Pall. Boraginaceae (IV. 1). 10 sp. Medit., Eur., As.

**Rinorea** Aubl. = *Alsodeia* Thou.

**Rivina** Plum. ex Linn. Phytolaccaceae. 5 sp. trop. Am. P 4, A 4 or 8, G 1. Berry.

**Robinia** Linn. Leguminosae (III. 6). 6 sp. N. Am. *R. Pseud-acacia* L.

(false Acacia, locust) is cultivated in S. Brit. Stipules thorny. The leaflets move upwards in hot or dry air. The horizontal shoots branch in one plane, while the upright show radial symmetry (p. 38). The base of the petiole forms a cap protecting a series of axillary buds.

**Rochea** DC. Crassulaceae. 4 sp. S. Afr. [For *R. falcata* DC. see Crassula.]

**Rodgersia** A. Gray. Saxifragaceae (I). 1 sp. China, Japan.

**Rodriguezia** Ruiz et Pav. Orchidaceae (28). 25 sp., epiphytic, in trop. Am. Between successive tubers there is often a long stretch of rhizome.

**Roelia** Linn. Campanulaceae (I. 1). 11 sp. S. Afr.

**Roemeria** Medic. Papaveraceae (II). 3 sp. Medit. to Afghanistan. *R. hybrida* DC. has become established as a cornfield weed in Norfolk and Cambridgeshire.

**Roettlera** Vahl = *Didymocarpus* Wall.

**Rohdea** Roth. Liliaceae (VII). 1 sp. *R. japonica* Roth, Japan. "It is, according to Delpino, a link between the Asparagoideae and the Araceae. It possesses a kind of spadix, on which the flrs. are arranged in a close uninterrupted spiral. The fact that the limb of the perianth is spread out exactly on a level with the points of the anthers and stigma led D. to think that fertilisation was effected by small animals crawling over the flrs. He observed snails (*Helix aspersa* &c.) greedily eating the perianth, which is yellow and fleshy; after devouring about 10 flrs. they crawled to another spadix. Only those flrs. on which the snails had crawled proved fertile; the flrs. were found to be barren to their own pollen. These observations leave no doubt that snails are really efficient fertilising agents." (Müller.)

**Romulea** Maratti. Iridaceae (I). 50 sp. Eur., Medit. (1 Brit., rare).

**Rondeletia** Linn. Rubiaceae (I. 3). 60 sp. trop. Am.

**Roridula** Linn. Droseraceae. 2 sp. S. Afr. Like *Drosera*, but with no movement of the leaf-tentacles.

**Rosa** Tourn. ex Linn. Rosaceae (III. 10). 100 sp. N. temp. and on trop. mts.; 6 in Brit., incl. *R. canina* L., the dog-rose. A variable genus like *Rubus* (pp. 123, 127). The flr. of *R. canina* is a pollen flr. (p. 98). The fruit (hip) consists of a number of achenes enclosed in the fleshy receptacle which closes over them after fertilisation. *R. centifolia* L. is the form from which the cabbage rose is derived; and numerous forms of this and other sp. are cultivated (see *Nat. Pfl.*). The thorns of roses are mere epidermal appendages.

**Rosaceae**. Dicotyledons (Archichl. Rosales). 90 gen. with 2000 sp. cosmop. Trees, shrubs and herbs, usually perennial; leaves alt. (exc. *Rhodotypos*), simple or compound, usually stip., the stipules often adnate to the petiole. Vegetative multiplication occurs in various ways, but especially by creeping stems—runners as in strawberry, or suckers as in raspberry. The flrs. are terminal, in racemose or

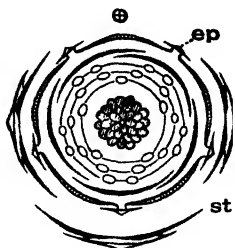
cymose infls. of various types, and show a great variety of forms. The receptacle is generally hollowed to a greater or less extent, so that various degrees of perigyny occur. Frequently there is a central protuberance bearing the cpls., even in the forms with very much hollowed receptacle. In a few cases (suborders II, IV) the cpls. are united to the receptacle and fully inferior. The receptacle often forms a part of the fruit. The flr. is usually  $\bar{5}$  and actinomorphic. K 5, often with an epicalyx of outer and smaller leaves (see *Potentilla*), usually imbricate; C 5, usually imbricate; A 2, 3, or 4 times as many as petals, or  $\infty$ , bent inwards in bud; G usually apocarpous and superior, rarely syncarpous or inferior; cpls. as many or 2 or 3 times as many as petals or  $\infty$  or 1—4. Ovules anatropous, usually 2 in each cpl. Style often lateral or basal. Fruit various, dry or fleshy; often an aggregate of achenes (*Potentilla*) or drupes (*Rubus*), or a single drupe (*Prunus*), or pome (*Pyrus*), and so on (see p. 108 and genera, esp. those mentioned, and *Fragaria*, *Geum*, *Rosa*, *Poterium*). Seed usually exalbuminous.

The flrs. in general are of simple type, with but slightly concealed honey (p. 64) and  $\infty$  sta. (p. 123). They are usually protandrous. *Poterium* sp. are anemophilous.

Few are of economic value (see *Pyrus*, *Rubus*, *Fragaria*, *Prunus*), but many are favourites as garden plants and shrubs.

*Classification and chief genera* (after Focke in *Nat. Pfl.*, q.v.). R. are very closely related to Saxifragaceae, some genera being almost arbitrarily placed in one order or the other; they are also nearly allied to Calycanthaceae, Combretaceae, Myrtaceae (the floral diagram of M. is practically the same as that of suborder II), Thymelaeaceae, and Leguminosae (through suborder VI).

- I. *SPIRAEOIDEAE* (cpls. 12—1, usually 5—2, whorled, neither on special carpophore nor sunk in receptacle, with 2 or more ovules in each; fruit usually dehiscent; sta. on broad base, tapering upwards; stipules often absent):
  1. *Spiraeaceae* (follicle, seeds not winged): *Spiraea*.
  2. *Quillajaceae* (follicle, seeds winged): *Quillaja*.
  3. *Holodisceae* (achene): *Holodiscus*.
- II. *POMOIDEAE* (cpls. 5—2, united to inner wall of receptacle, usually syncarpous; axis fleshy in fruit, stipules):
  4. *Pomariaceae*: *Pyrus*.
- III. *ROSOIDEAE* (cpls.  $\infty$  or rarely 1 on carpophore, sometimes enclosed in axis in fruit; fruit 1-seeded indehiscent):



Floral Diagram of *Potentilla fruticosa* (after Eichler). ep = epicalyx, st. = stipules of bracts and bracteoles.

5. *Kerrieae* (stips. distinct; axis not forming part of fruit; sta. tapering upwards from broad base; cpls. few, whorled; sta.  $\infty$ ): *Rhodotypos*, *Kerria*.
  6. *Potentilleae* (as 5, but cpls. usually  $\infty$ , in a head, or rarely few and then sta. also few):
    - 6 a. *Rubinae* (drupes, no epicalyx): *Rubus*.
    - 6 b. *Potentillinae* (achenes; seed pendulous; usually epicalyx): *Fragaria*, *Potentilla*.
    - 6 c. *Dryadinae* (as b, but seed erect): *Geum*, *Dryas*.
  7. *Cercocarpeae* (stipules slightly developed; torus tubular; cpl. 1; achene): *Adenostoma*, *Purshia*.
  8. *Ulmariaceae* (torus flat or nearly so; sta. with narrow base): *Ulmaria*.
  9. *Sanguisorbeae* (torus cup-like enclosing cpls., hardening in fruit; cpls. 2 or more): *Alchemilla*, *Agrimonia*, *Poterium*.
  10. *Roseae* (torus cup-like or tubular, enclosing  $\infty$  cpls., and fleshy in fruit): *Rosa*.
- IV. *NEURADOIDEAE* (cpls. 5—10 syncarpous and united to torus, which is dry in fruit; herbs).
11. *Neuradeae*: *Neurada*.
- V. *PRUNOIDEAE* (cpl. 1, rarely 2—5, free of torus; drupe; trees with simple leaves; style almost terminal; ovules pendulous; frs. regular).
12. *Prunae*: *Nuttallia*, *Prunus*.
- VI. *CHRYSOBALANOIDEAE* (as V, but style basal and ovules erect):
- 13 a. *Chrysobalaninae* (nearly regular): *Chrysobalanus*.
  - 13 b. *Hirtellinae* (zygomorphic): *Hirtella*.
- [Placed in *Rosales* by Benth.-Hooker, in *Rosiflorae* by Warming, who splits up the order considerably.]
- Rosales.** The 14th cohort (Engler) of *Archichlamydeae* (p. 137). The 11th cohort (Benth.-Hooker) of *Polypetalae* (p. 142).
- Rosiflorae** (Warming). The 19th cohort of *Choripetalae* (p. 146).
- Roscoea** Sm. *Zingiberaceae*. 4 sp. Himal. *R. purpurea* Sm. is often cultivated. It has a zygomorphic flr. with two lips. Insects landing on the lower and probing for honey find their way obstructed by two projecting spikes from the lower end of the anther; pressure on these brings the anther (with the stigma, which projects beyond it) down upon the insect's back. The flr. is protandrous. [Cf. *Salvia*.]
- Rosmarinus** (Tourn.) Linn. *Labiatae* (I. 2). 1 sp. *Medit.*, *R. officinalis* L., the rosemary, a xerophytic shrub with leaves rolled back and stomata in hairy grooves on lower side (cf. *Ericaceae*, *Empetrum*). Oil of rosemary is employed in perfumery &c.
- Rotala** Linn. *Lythraceae*. 32 sp. trop. and subtrop., in wet places.
- Rottboellia** Linn. f. (excl. *Ophiurus* Gaertn. f.). *Gramineae* (II). 30 sp. trop.



**Roupala** Aubl. Proteaceae (II). 39 sp., 1 in Austr., 2 in New Caled., the rest in trop. Am.

**Rourea** Aubl. Connaraceae. 40 sp. trop.

**Roxburghia** Banks = *Stemona* Lour.

**Roxburghiaceae** (Benth.-Hooker) = *Stemonaceae*.

**Roydsia** Roxb. Capparidaceae (IV). 3 sp. Indo-mal.

**Royena** Linn. Ebenaceae. 13 sp. Afr. *R. lucida* L. yields useful timber.

**Rubia** (Tourn.) Linn. Rubiaceae (II. 21). 5 sp. Eur., As., Afr., S. Am. (1 in Brit.). *R. tinctorum* L. is the madder, formerly largely cultivated for its dye (alizarin), which is now prepared artificially.

**Rubiaceae**. Dicotyledons (Symptet. Rubiales). 350 gen. with 4500 sp. forming one of the largest orders of plants. Most are trop., but a number (esp. of the *Galieae*) are temp., and *Galium* itself has a few arctic sp. Trees, shrubs and herbs with decussate stip. entire or rarely toothed leaves. The stipules exhibit great variety of form; they stand either between the petioles (*interpetiolar*) or between the petiole and the axis (*intrapetiolar*). They are frequently united to one another and to the petioles, so that a sheath is formed round the stem. The two stipules—one from each leaf—that stand side by side are usually united, and in the *Galieae*, to which the Brit. sp. belong, are leaf-like, and often as large as the ordinary leaves; a characteristic appearance is thus produced, the plants seeming to have whorls of leaves; and it is only by noting the axillary buds that a clue is obtained to the real state of affairs. The number of organs—leaves and stipules—in a whorl varies from 4 upwards, according to the amount of 'fusion' or 'branching' of the stipules. The simplest case is a whorl of 6, each leaf having 2 separate stipules; if the stipules be united in pairs, a whorl of 4 results; if each stipule be branched into two, we get a whorl of 10, and, if the centre pair of half-stipules on either side be united, a whorl of 8, and so on.

Several *R.* are myrmecophilous (p. 117, and cf. *Cecropia*, *Acacia*), e.g. *Myrmecodia*, *Cuviera*, *Duroia*, *Hydnophytum*.

The infl. is typically cymose. Solitary terminal flrs. are rare; small dichasia are more frequent; the most common case is a much branched cymose panicle.

The flr. is usually ♂, regular, epigynous, 4- or 5-merous. K 4–5, epigynous, often almost absent, usually open in aestivation, sometimes with one sepal larger than the rest and brightly coloured (*Mussaenda* &c.); C (4–5), epigynous, valvate, convolute, or imbricate; A 4–5, alt. with petals, epipetalous;  $\bar{G}$  (2) rarely (1–∞), 2-loc. with 1–∞ anatropous ovules in each loc.; ovules erect, pendulous, or horizontal; style simple; stigma capitate or lobed. Fruit a capsule (septi- or loculi-cidal), berry or schizocarp. Embryo small, in rich endosperm.

Most *R.* have conspicuous insect-pollinated flrs. The Brit. sp.

have small flrs. with freely exposed or but slightly concealed honey, and are chiefly visited by flies (see p. 68); of the trop. sp. many have bee- and Lepidoptera-flrs. with long tubes. Honey is usually secreted by an epigynous nectary round the base of the style. Heterostylism is common, and dioecism sometimes occurs. [See Burck in *Ann. Buitenz.* III. 1883, and IV. 1884.]

Several R. are of economic importance, *e.g.* *Cinchona*, *Coffea*, *Uragoga*, *Rubia*, &c.

*Classification and chief genera* (after Schumann). The R. are closely allied to *Caprifoliaceae* (q.v.) and less nearly to *Compositae* &c.

I. *CINCHONOIDEAE* (ovules  $\infty$  in each locus).

A. *CINCHONINAE* (fruit dry):

a. Flrs. solitary or in decussate panicles.

a. Flr. regular; seed not winged; corolla valvate.

1. *Condamineae*: *Condaminea*.

2. *Oldenlandieae*: *Oldenlandia*, *Houstonia*, *Pentas*.

b. As a, but corolla imbricate or convolute.

3. *Rondeletieae*: *Rondeletia*.

c. As b, but seed winged.

4. *Cinchoneae*: *Cinchona*, *Bouvardia*, *Cosmibuena*.

d. As a, but corolla 2-lipped.

5. *Henriquezieae*: *Henriquezia*.

$\beta$ . Flrs. in heads.

6. *Naucleae*: *Uncaria*, *Nauclea*.

B. *GARDENINAE* (fruit fleshy):

7. *Mussaendeae* (corolla valvate): *Mussaenda*.

8. *Gardenieae* (corolla imbricate or convolute): *Randia*, *Gardenia*, *Posoqueria*, *Duroia*.

II. *COFFEOIDEAE* (ovules 1 in each locus).

A. *GUETTARDINAE* (ovule pendulous; micropyle facing upwards):

9. *Alberteae*: *Alberta*.

10. *Knoxieae*: *Knoxia*.

11. *Vanguerieae*: *Plectronia*, *Cuviera*.

12. *Guettardeae*: *Guettarda*.

13. *Chiococceae*: *Chiococca*.

B. *PSYCHOTRIINAE* (ovule ascending; micropyle facing downwards):

a. Corolla convolute.

14. *Ixoreae*: *Coffea*, *Ixora*, *Pavetta*.

$\beta$ . Corolla valvate.

a. Ovules inserted at base of locus.

15. *Psychotrieae*: *Psychotria*, *Rudgea*, *Uragoga*, *Lasianthus*, *Myrmecodia*.

16. *Paederieae*: *Paederia*.

17. *Anthospermeae*: *Nertera*, *Coprosma*, *Mitchella*.

18. *Coussareae*: *Faramaea*.

b. Ovules on septum.

19. *Morindeae* (stip. undivided, not leafy; trees and shrubs):  
Morinda.
20. *Spermacoceae* (stip. divided; shrubs and undershrubs): Bor-  
reria.
21. *Galieae* (stip. leafy; herbs): Sherardia, Crucianella, Asperula,  
Galium, Rubia.

[Placed in Rubiales by Benth.-Hooker and Warming.]

**Rubiales.** The 7th cohort (Engler) of Sympetalae (p. 140). The 1st cohort (Benth.-Hooker) of Gamopetalae (p. 143). The 8th cohort (Warming) of Sympetalae (p. 147).

**Rubus** (Tourn.) Linn. Rosaceae (III. 6 a). A dominant and largely varying genus (p. 123) comprising perhaps 200 sp., most of which are represented by a large number of varieties, often, as in the cases of Rosa, Salix, and Hieracium, raised to specific rank in local floras, &c. The genus occurs in almost all parts of the world, especially N. temp. regions (5 or 6 sp. in Brit.). The flrs. are conspicuous; honey is secreted by a ring-shaped nectary upon the hollowed axis just within the insertion of the sta. The flrs. are homogamous, and visited by many insects, including bees. The fruit is an aggregate of drupes. Several sp. present special points of interest. *R. Chamaemorus* L. is the cloudberry, an arctic plant found in Scotland on the hills. It has creeping underground stems by means of which a large vegetative multiplication is carried on. The flrs. are solitary, terminal and unisexual. Occasionally ♀ flrs. occur. The plant is always described as dioecious, but it has been stated that there is sometimes a difference in sex between two plants, one of which appears to have sprung vegetatively from the other. *R. Idaeus* L. is the raspberry. It multiplies largely by suckers—stems which grow out horizontally beneath the soil to some distance, then turn up and give rise to new plants which flower in their second year. *R. fruticosus* L. is a general specific name for the innumerable varieties of the common bramble or blackberry. It is a hook-climber (the hooks being emergences) sprawling over the surrounding vegetation. Branches which reach the soil often take root there and grow up into new plants. *R. caesius* L. is the dewberry, whose fruits are covered with bloom (wax) like grapes. *R. occidentalis* L. is the black-cap raspberry or trimbleberry of N. Am. *R. australis* Forst. f. is an interesting sp. with the blades of the leaves reduced to the minimum (p. 180).

**Rudbeckia** Linn. (excl. *Lepachys* Rafn.). Compositae (v). 30 sp. N. Am.

**Rudgea** Salisb. Rubiaceae (II. 15). 100 sp. trop. Am. Some are heterostyled.

**Ruellia** Plum. ex Linn. Acanthaceae (IV. A). 200 sp. trop. and sub-trop. The capsule explodes. The seeds possess surface hairs which, when wetted, swell and adhere to the soil.

**Rumex** Linn. Polygonaceae (I. 2). 100 sp. esp. in N. Temp. zone (12

British, of which several, known as docks and sorrels, are among our commonest plants). Flrs. of the type usual in the order, wind-fertilised, with large stigmas (see order for diagram, and cf. *Rheum*). *R. Hydro-lapathum* Huds. is said to produce aerating roots like a mangrove (p. 189). The roots of *R. hymenosepalus* Torr. (N.W. Am.), the Canaigré, are used for tanning.

**Ruppia** Linn. Potamogetonaceae. 1 sp., *R. maritima* L., in salt or brackish water, temp. and sub trop. A slender swimming plant, with the habit of a small-leaved Potamogeton. The flrs. are borne just at the surface of the water, where fertilisation occurs by pollen floating upon the surface. Each spike consists of 2 flrs. not enclosed in the spathe at the flowering time. The flr. has 2 sta. with small outgrowths from the connectives, and four cpls.

**Ruprechtia** C. A. Mey. Polygonaceae (III. 6). 20 sp. S. Am.

**Ruscus** (Tourn.) Linn. Liliaceae (VII). 3 sp. Medit., Eur. *R. aculeatus* L., butcher's broom, in Brit., a small shrub. In the axils of scaly leaves stand leaf-like phylloclades; halfway up each is another scaly leaf, in whose axil stands the flr. Fruit a berry.

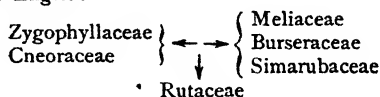
**Russelia** Jacq. Scrophulariaceae (II. 6). 6 sp. Mexico, Chili. *R. juncea* Zucc. is often cultivated in greenhouses. It is a xerophyte with much reduced leaves and pendulous green stems. Shoots sometimes appear under cultivation with broad leaves (reversion to ancestral type).

**Ruta** (Tourn.) Linn. Rutaceae (II). 50 sp. Medit., As. *R. graveolens* L., the rue, is commonly cultivated in Brit. It is a strongly smelling shrub owing to the presence in the leaves &c. of an ethereal oil. The terminal flr. of the infl. is 5-merous, the lateral flrs. 4-merous. The sta. lie in pairs in the boat-like petals; one by one they bend upwards over the stigma, dehisce and fall back; when all have done this, the stigma ripens, and finally the sta. again move up and effect self-fertilisation. The dirty-yellow strongly-scented flrs. are chiefly visited by small flies. Rue is employed in medicine as a narcotic and stimulant.

**Rutaceae.** Dicotyledons (Archichl. Geraniales). 100 gen. with 800 sp. trop. and temp., esp. S. Afr. and Austr. Most are shrubs and trees, often xerophytic and frequently of heath-like habit (e.g. *Diosma*). Leaves alt. or opp., exstip., usually compound, with glandular dots, often aromatic. In many *Aurantieae* there are short shoots whose leaves are reduced to thorns (cf. *Cactaceae*). Infl. of various forms, usually cymose. Flr. ♂, rarely unisexual, regular or zygomorphic, 5-4-merous (see *Ruta*), with a large disc below the gynœceum. K 5 or 4, the odd sepal posterior; C 5 or 4, imbricate; A 10 or 8, obdiplostemonous, or 5, 3, 2, or ∞, with introrse anthers; G (5 or 4), rarely (3-1) or (∞), often free at base and united above by the style (cf. *Apocynaceae*), multiloc.; ovules 2-∞ in each loc., anatropous with ventral raphe and micropyle facing upwards. Fruit various; schizocarps, drupes, berries, &c. Seeds with or without endosperm.

Several R. are or have been used in medicine, chiefly on account of the oils they contain, *e.g.* Ruta, Galipea, Toddalia, &c. Citrus yields important fruits, and Chloroxylon a dye-stuff.

*Classification and chief genera* (after Engler): The groups of R. differ considerably among themselves, and several of them were formerly regarded as independent orders. The relationships to allied orders are thus given by Engler:



The characters of only a few of the sub-orders are given here.

A. Cpls. usually 4—5, rarely 3—1 or more, often only united by style,  $\pm$  divided when ripe; loculicidal dehiscence usually with separation of endocarp; rarely 4—1 fleshy drupes.

#### RUTOIDEAE.

- I. *Zanthoxyleae*: Zanthoxylum, Choisya.
- II. *Ruteae*: Ruta, Dictamnus.
- III. *Boronieae*: Boronia, Eriostemon, Correa.
- IV. *Diosmeae*: Calodendron, Adenandra, Diosma.
- V. *Cusparieae*: Almeidea, Galipea, Cusparia.

#### DICTYOLOMOIDEAE.

- VI. *Dictyolomeae*: Dictyoloma.

#### B. FLINDERSIOIDEAE.

- VII. *Flindersieae*: Flindersia, Chloroxylon.

#### C. SPATHELIOIDEAE.

- VIII. *Spathelieae*: Spathelia.

#### D. TODDALIOIDEAE.

- IX. *Toddalieae*: Ptelea, Toddalia, Skimmia.

E. Berry, often with periderm, and with pulp derived from sappy emergences of cpl. wall. Seeds exalbuminous, often with 2 or more embryos. Lysigenous oil glands.

#### AURANTIOIDEAE.

- X. *Aurantieae*: Glycosmis, Limonia, Atalantia, Feronia, Aegle, Citrus.

[Benth.-Hooker place the order in Geraniales, but add sub-order VII. to Meliaceae. Warming places it in Terebinthinae.]

**Rynchospora** Vahl. Cyperaceae (II). 150 sp. N. temp.; 2 in Brit.

**Sabal** Adans. Palmae (I. 2). 8 sp. Am.

**Sabbatia** Adans. Gentianaceae (I. 2). 12 sp. N. Am.

**Sabia** Colebr. Sabiaceae. 17 sp. S. and E. As.

**Sabiaceae**. Dicotyledons (Archichl. Sapindales). 4 gen. with 65 sp. trop. and E. As. Trees, shrubs or lianes with alt. exstip. imparipinnate or simple leaves. Infl. a panicle or cymose panicle, with bracts and bracteoles. Flrs. usually  $\frac{5}{5}$ . K (3—5), imbricate or free;

C 4—5, sometimes united at base, imbricate, the inner 2 much reduced; A 5, opp. petals, all or only 2 fertile, the rest being staminodial; ovary superior 2-loc.; in each loc. usually 2 axile pendulous or horizontal semi-anatropous ovules with micropyle upwards. Indehiscent fruit with exalbuminous seeds. *Chief genera*: *Sabia*, *Meliosma*. Placed in Sapindales by Benth.-Hooker.

**Saccharum** Linn. Gramineae (11). 12 sp. trop., esp. Old World. The most important is *S. officinarum* L., the sugar cane, a native (?) of trop. E. As., now cultivated in most trop. regions. From the rhizome there spring each year shoots which may reach a height of 12—15 feet and a thickness of 2 inches; the outer tissues have much silica in their cell-walls. The infl. is a dense woolly spike, the first and second glumes of each spikelet being covered with long hairs. The cultivated form has always been vegetatively propagated (pieces of the halm, each bearing a bud, are planted), but recently a more vigorous race has been raised from seed (cf. pp. 44 seq.). The sugar is contained in the soft central tissues of the stem; the canes are cut before flowering and crushed between rollers to extract the juice, which undergoes various subsequent processes.

**Saccoglottis** Endl. Humiriaceae. 10 sp. trop. Am., Afr.

**Saccolabium** Blume. Orchidaceae (31). 20 sp. Indo-mal. Epiphytes.

**Sadleria** Kaulf. Polypodiaceae. 2 sp. Sumatra, Sandwich Is.

**Sagina** Linn. Caryophyllaceae (11. 1). 20 sp. N. temp.; 4 in Brit. (pearl-wort). Small herbs with inconspicuous, sometimes apetalous flrs.; these are homogamous and pollinate themselves.

**Sagittaria** Rupp. ex Linn. Alismaceae. 12 sp., 11 in Am., the other, *S. sagittifolia* L. (arrow-head) in Eur. (incl. Corolla). It is a water-plant with a short rhizome bearing leaves of various types, the number of each kind depending on the depth of the water, &c. (see p. 171, and Goebel's *Pflanzenbiol. Sch.* II. p. 290). The fully submerged leaves are ribbon-shaped, the floating ones have an ovate blade, whilst those (usually the majority) that project above water are arrow-shaped (sagittate). In the leaf-axils are formed the 'renewal' shoots which last over the winter; these are short branches which burrow into the mud and swell up at the ends each into a large bud whose central axis is swollen with reserve-materials; in spring this develops into a new plant. The diclinous racemose infl. projects above water; the ♀ flrs. are lower down than the ♂. The ♂ contains ∞ sta., the ♀ ∞ cpls. The flrs. contain honey, and are visited by flies.

**Sagus** Rumph ex Gaertn. = *Metroxylon* Rottb.

**Saintpaulia** H. Wendl. Gesneriaceae (1). 1 sp. E. Afr., *S. ionantha* H. Wendl., a recent discovery, but already cultivated in botanic gardens and likely to become popular. The flr. resembles in appearance that of *Exacum*, and exhibits a similar dimorphic symmetry. In some of the flrs. the style projects to the left over the corolla, in others to the right (cf. *Exacum*, *Cassia*).

**Salacia** Linn. Hippocrateaceae. 80 sp. trop. S. Am., a few in trop. Afr., As., Austr. Many are lianes with dimorphic branches, one form being adapted for climbing (p. 177).

**Salaxis** Salisb. Ericaceae (IV. 10). 22 sp. Cape Colony.

**Salicaceae.** Dicotyledons (Archichl. Salicales). 2 gen. with 180 sp. N. temp., trop. and sub trop. Shrubs or trees with stip. leaves and much vegetative propagation by suckers. Flrs. naked, in catkins or spikes, dioecious (many hybrids exist). The catkins arise in autumn and remain as buds through the winter, developing in early spring. The ♂ flr. consists of 2—30 sta. in the axil of a bract, the ♀ usually of (2) cpls. transversely placed, syncarpous with parietal placentation; ovules ∞, anatropous. Seeds exalbuminous with basal tufts of hairs. Placed in Saliciflorae by Warming, as an anomalous order at the end of Incompletae by Benth.-Hooker.

**Salicales.** The 3rd cohort of Archichlamydeae (p. 136).

**Saliciflorae** (Warming). The 1st cohort of Choripetalae (p. 146).

**Salicornia** (Tourn.) Linn. Chenopodiaceae (7). 9 sp. on sea-coasts.

*S. herbacea* L. (saltwort) cosmop., incl. Brit. (p. 188). Succulent herbs, with the habit of a cactus, leafless and with jointed nodes. Flrs. in groups of 3 or more, one group sunk in the tissue on either side of each internode. Perianth fleshy; sta. 1 or 2.

**Salisburia** Sm. = Ginkgo Linn.

**Salix** (Tourn.) Linn. Salicaceae. 160 sp., chiefly N. temp. The sp. are very variable and there are many hybrids (cf. Rubus, Rosa, and see Ch. II.). 12 in Brit. (willow, sallow, &c). The branching is monopodial, but the terminal bud usually dies, and the next lateral bud continues the axis. There is extensive vegetative propagation by suckers. Some sp. e.g. *S. alba* L. are often pollarded, or cut off at a height of 8 feet or so; from the callus formed upon the wounds new shoots spring, and thus the 'crown' of shoots is produced (p. 167). Among the Brit. sp. are *S. herbacea* L., the dwarf or arctic willow, a creeping alpine and arctic form (p. 190), and *S. lanata* L. &c. alpine forms with very woolly leaves. The flrs. contain honey, and as they appear in early spring, before the leaves, and when they have but few competitors, they receive a great many visits from insects, especially from bees. *S. viminalis* L. is the osier, whose twigs are used in making baskets &c. *S. babylonica* L. is the weeping willow. [See p. 184.]

**Salpiglossis** Ruiz et Pav. Solanaceae (v). 8 sp. S. Am.

**Salsola** Linn. Chenopodiaceae (10). 40 sp. chiefly Eur., As., maritime or on salt steppes (p. 187). *S. Kali* L. (glass-wort) in Brit., a very fleshy plant with leaves ending in spines. A variety *tragus* Moq. of this sp. (Russian thistle) has in recent years become a pest of agriculture in Dakota and other parts of N. Am. (*Bot. Gaz.* 1895, p. 501).

**Salvadora** Garcin. ex Linn. Salvadoraceae. 2 sp. W. As., Afr. *S.*

*persica* L. is said to be the mustard of the New Testament. Its leaves taste like mustard.

**Salvadoraceae.** Dicotyledons (Sympet. Contortae). 3 gen. with 6 sp. As., Afr. Shrubs and trees with opp. entire stip. leaves and racemose infls. Flrs. ♀ or unisexual, regular. K (2—4); C (4—5) or 4—5, with teeth or glands on the inner side; A 4—5, epipetalous or not. Ovary superior, 1—2-loc. with 1—2 erect anatropous ovules in each loc. Fruit a 1-seeded berry or drupe. Seed exalbuminous. *Genera*: Azima, Dobera, Salvadora. The relationships are doubtful, for we do not know if the polypetaly of A. and D. is original or secondary. If the former, the order must perhaps be placed near Celastraceae. Benth.-Hooker place it in Gentianales, Warming in Contortae.

**Salvia** (Tourn.) Linn. Labiatae (vi. 6). 500 sp. trop. and temp. *S. Verbenaca* L. (sage) and *S. pratensis* L. (clary) in Brit. The sta. are reduced to 2 (the anterior), each of which has a sort of T-shape, the connective of the versatile anther being greatly elongated. The stalks of the sta. stand up close together across the mouth of the flr., and a bee, in pushing its head or tongue down towards the honey, comes into contact with the inner end of the anther, and raising it causes the outer to descend upon its back and to rub it with pollen. In the lower forms of *S.* both ends of the lever bear fertile anthers; but in all the higher forms the useless half-anther at the inner end is aborted, and the outer half of the connective is much longer than the inner (compare *S. officinalis* with *S. pratensis*). The flr. is protandrous, and in the later stage the style bends downwards and places the stigma in a position to be touched first by an entering insect. Some sp. have coloured bracts at the top of the infl., adding to its conspicuousness. *S. officinalis* L. (Medit.) is the garden sage.

**Salvinia** (Mich.) Schreb. Salviniaceae. 5 sp. trop. and warm temp., of which *S. natans* Hoffm. is best known. The plant floats freely on the water; at each node is a whorl of three leaves, and the whorls alternate with one another. There are two floating leaves derived from the upper half of a segment of the apical cell (see order), and a submerged leaf derived from the lower. There are no roots, their function being performed by the finely divided submerged leaves (see p. 171, and compare *Trapa*, *Ranunculus*, *Cabomba*). The sporocarps are borne several together as outgrowths from the base of a submerged leaf. The microspores germinate inside the sporangium, the prothalli emerging through its wall as fine tubes, at the end of which the antheridia form.

**Salviniaaceae.** Filicineae Leptosporangiatæ (Heterosporous). A small family, composed of two genera, *Salvinia* and *Azolla*, comprising about 9 sp., trop. and temp. They are water plants, with a stem floating upon the water, and growing by a two-sided apical cell (3-sided in the young embryo, as in other Filicineae). A dorsiventral construction thus arises; segments are cut off right and left from the two-sided



apical cell, and the first division of each of these segments divides it into a dorsal and a ventral half. In *S.* the dorsal halves give rise to the floating, the ventral to the submerged leaves; in *A.* the former give rise to the leaves, the latter to the branches and roots. The sporangia are grouped into sori; the sorus is enclosed in a highly developed indusium, forming a sporocarp. Each sorus contains only one kind of sporangium (micro- or mega-sporangia). The sporocarp is an outgrowth of a leaf,—in *S.* of a submerged leaf, in *A.* of the ventral lobe of an ordinary leaf. The spore is covered with an *epispore*, consisting of hardened frothy mucilage. It sinks, when set free from the sporangium. On germination the microspore forms a rudimentary ♂ prothallus consisting of one (? more) vegetative cell and an antheridium. The megaspore forms a ♀ prothallus, which remains enclosed in the burst spore. This prothallus has two parts, an upper small-celled green part on which are borne the archegonia, and a lower colourless part (of one or more large cells), in which reserves are stored up for the use of the young plant which will be formed from a fertilised ovum (compare *Selaginella* and *Phanerogams*).

**Sambucus** (Tourn.) Linn. Caprifoliaceae (1). 20 sp. N. temp., S. Am., As. to Austr. *S. nigra* L. is the common elder. *S. Ebulus* L. is also found in Brit. The genus differs from the rest of the order in having compound leaves and extrorse anthers. It also possesses well-marked stipules. There has of late been some discussion about the proper position to be assigned to it. Fritsch (*Nat. Pfl.*) assigns it a separate sub-order. Later he proposed (*Bot. Cent.* 50, 1892, p. 137, 168) to fuse Caprifoliaceae with Rubiaceae, but to add *S.* itself to Valerianaceae. Höck (*Bot. Cent.* 50, 1892, p. 233) thinks this hardly justifiable and proposes to erect a new family, *Sambucaceae*, forming a link between the cohorts Rubiales and Aggregatae. He gives a scheme showing probable relationships of these orders to the other Sympetalae with inferior ovary, and to Umbelliferae &c. A wine is prepared from elder berries.

**Samolus** (Tourn.) Linn. Primulaceae (11). 8 sp.; *S. Valerandi* L., the brook-weed, is cosmop., the rest *S. Hemisph.* The whole plant dies down in autumn, but young shoots form in summer and take root, so that the parent plant is replaced. The bracts of the flrs. are 'adnate' to the axes, so as to look like solitary bracteoles; this is due to a process of growth carrying both bract and axis up together (see p. 34 and cf. *Solanaceae*).

**Samyda** Linn. Flacourtiaceae. 4 sp. W. Ind., Mexico.

**Samydaceae** (Benth.-Hooker). An order in cohort Passiflorales, comprising the genera *Samyda*, *Casearia*, &c.; placed in Flacourtiaceae by Engler.

**Sanguinaria** Dill. ex Linn. Papaveraceae (11). 1 sp. Atlantic N. Am., *S. canadensis* L., the blood-root. It has a thick rhizome giving off annually one leaf and a 1-flowered scape. The rhizome is used in medicine.

**Sanguisorba** Rupp. ex Linn. = *Poterium* Linn. *S. minor* Scop. = *P. Sanguisorba*; *S. officinalis* L. = *P. officinale*.

**Sanicula** (Tourn.) Linn. Umbelliferae (3). 12 sp. Eur., As., Afr., Am. *S. europaea* L. (sanicle) in Brit. Flrs. in cymose umbels, themselves arranged in dichasia. Fruit hooked for animal-distribution.

**Sansevieria** Thunb. Liliaceae (VIII). 10 sp. trop. Afr. to E. Ind. Xerophytes with fleshy leaves. *S. zeylanica* Willd. is largely cultivated in the tropics as a source of fibre (bow-string hemp).

**Santalaceae**. Dicotyledons (Archichl. Santalales). 26 gen. with 150 sp. of semi-parasitic shrubs, trees and herbs, resembling the Loranthaceae in many ways. Some are stem-parasites like mistletoe, others root-parasites like *Rhinanthus* (e.g. *Thesium*). [See *Nat. Pfl.* for details of anatomy &c. of the suckers.] The total infl. may be a raceme, spike, head, &c., but often, instead of the single flr. in each axil, there is a little cyme of 3, as in Loranthaceae. The flrs. are ♀ or unisexual. They have a perigynous or epigynous disc and a simple perianth (sepaloid or petaloid). The sta. are equal in number to, and inserted on, the perianth-leaves. Ovary inferior, 1-loc., with a central placenta bearing 1—3 ovules. Fruit a nut or drupe. Seed 1, with no testa, and with much endosperm. [For details of embryo-sac and other interesting features see Hieronymus, in *Nat. Pfl.*] *Chief genera*: *Santalum*, *Thesium*. Placed in Achlamydosporeae by Benth.-Hooker, who unite Grubbiaceae and Myzodendraceae to S.; in Hysterophyta by Warming.

**Santalales**. The 7th cohort of Archichlamydeae (p. 136).

**Santalum** Linn. Santalaceae. 8 sp. E. Ind. Parasitic trees. *S. album* L. furnishes the true sandal-wood (yellow or white).

**Santolina** Tourn. ex Linn. Compositae (VII). 8 sp. South-west Eur. *S. Chamaecyparissus* L. is officinal.

**Sanvitalia** Gualt. Compositae (V). 8 sp. Am.

**Sapindaceae**. Dicotyledons (Archichl. Sapindales). About 120 gen. with 1000 sp. trop. and subtrop. 5 gen. (*Serjania*, *Paullinia*, &c.) with 300 sp. are lianes, the rest erect trees or shrubs. The lianes climb by aid of tendrils, which are metamorphosed infl.-axes and are usually branched or sometimes watch-spring-like (p. 176); their stems often show peculiar internal anatomy. Leaves alt., stip. in the climbing sp., usually compound, pinnate; in the climbing sp. there is usually a true terminal leaflet, but not in the erect sp.; in these one of the last pair of leaflets often becomes terminal, so that the leaf is asymmetric. The tissues of the plants usually contain resinous or latex-like secretions in special cells. The infl. is cymose, usually a cincinnus, with bracts and bracteoles.

Flr. unisexual (the sta. are apparently well developed in the ♀ so that it is easily mistaken for ♂, but the pollen is useless, and the anthers do not open), generally monoëcious, regular or often obliquely zygomorphic, 5- or 4-merous. K usually 5, rarely (5), imbricate or

rarely valvate or open, sometimes apparently 4-merous by union of 2 sepals; C usually 5, imbricate, with well-marked disc between it and the sta.; A usually 5 + 5 in one whorl, often with 2 absent, more rarely 5, 4, or  $\infty$ , inserted within or rarely upon the disc round the rudimentary ovary.  $\bar{G}$  in  $\bar{q}$  flr. usually (3), 3-loc. with terminal style; ovules usually 1 in each loc., ascending, with ventral raphe. Fruit a capsule, nut, berry, drupe, schizocarp, or samara, usually large, often red; seed often arillate, with no endosperm; embryo usually curved.

Many S. are of economic value; several yield valuable timber; Nephelium, Litchi, and others furnish edible fruits.

*Classification and chief genera* (after Radlkofer):

I. *EUSAPINDACEAE* (ovules solitary in loculi, erect or ascending, with micropyle downwards): *Serjania*, *Paullinia*, *Sapindus*, *Talisia*, *Schleichera*, *Litchi*, *Nephelium*, *Pappea*, *Cupania*, *Blighia*.

II. *DYSSAPINDACEAE* (ovules usually 2 or several in each loc., in the first case erect or pendulous, in the second horizontal, rarely 1 pendulous with micropyle upwards): *Koelreuteria*, *Dodonaea*.

[Benth.-Hooker unite to S. the *Aceraceae*, *Staphyleaceae* and *Hippocastanaceae*, placing the order in *Sapindales*; Warming places it in *Aesculinae*.]

**Sapindales.** The 16th cohort (Engler) of *Archichlamydeae* (p. 138).

The 10th cohort (Benth.-Hooker) of *Polypetalae* (p. 142).

**Sapindus** Tourn. ex Linn. *Sapindaceae* (1). 11 sp. trop. and subtrop. exc. Afr. and Austr. The berries of *S. Saponaria* L. (Am.) form a lather with water, and are sometimes used as soap; they contain saponin.

**Sapium** P. Br. *Euphorbiaceae* (A. 11. 7). 25 sp. trop. Seeds of *S. sebiferum* Roxb., the tallow-tree of China, are coated with fat; they also yield an oil by pressure.

**Saponaria** Linn. *Caryophyllaceae* (1. 2). 20 sp. N. temp., chiefly Medit. *S. officinalis* L. (soapwort) in Brit. Its leaves lather if rubbed with water. Flrs. protandrous, butterfly-visited.

**Sapota** Plum. ex Mill. = *Achras* Linn.

**Sapotaceae.** *Dicotyledons* (*Sympet. Ebenales*). 31 gen. with 370 sp. in all trop. lands. They are mostly trees with entire leathery leaves, sometimes stipulate. They are commonly hairy with 2-shanked hairs, and contain secretory passages in pith, cortex and leaves. The flrs. are solitary or in cymose bunches in the leaf-axils or on old stems, bracteolate,  $\bar{g}$ , regular or not.  $K$  2 + 2, 3 + 3, 4 + 4, or 5; C usually equal in number to sepals, and alternating with the calyx as a whole, as in *Cruciferae*, rarely in 2 whorls. In *Mimusopeae* the petals have dorsal appendages like themselves, giving the appearance of more than one whorl. Sta. in 2 or 3 whorls, but frequently the outer ones are staminodial or absent; anthers commonly extrorse.  $\bar{G}$  superior,

syncarpous, multiloc. ; cpls. as many or twice as many as the number of sta. in a whorl, or more ; ovules inserted at base of axile placenta, one in each loc., anatropous with micropyle facing downwards ; style simple. Fruit a berry, the flesh sometimes sclerenchymatous near the surface. Seeds few or one, usually albuminous ; endosperm oily ; testa hard and rich in tannin.

Many *S.* furnish useful products, especially gutta-percha ; see the genera below.

*Classification and chief genera* (after Engler) :

I. *Palauquieae* (petals without appendages) : *Bassia*, *Payena*, *Palauquium*, *Achras*, *Butyrospermum*, *Sideroxylon*, *Chrysophyllum*.

II. *Mimusopeae* (petals with appendages—see above) : *Mimusops*.

[Placed in Ebenales by Benth.-Hooker, in Diospyrinae by Warming.]

**Sarcocalyx** Walp. = *Aspalathus* Linn.

**Sarcocapnos** DC. Papaveraceae (III). 3 sp. Medit.

**Sarcocaulon** Sweet. Geraniaceae. 4 sp. S. Afr. Xerophytes with fleshy stems. When the leaf falls it leaves behind the base of the petiole which hardens into a thorn.

**Sarcococca** Lindl. Buxaceae. 4 sp. E. Ind., Malaya.

**Sarcocolla** Linn. Penaeaceae. 4 sp. Cape Colony.

**Sarcodes** Torr. Pyrolaceae. 1 sp. California.

**Sarcoglottis** Presl = *Spiranthes* Rich.

**Sarcostemma** R. Br. Asclepiadaceae (II. 2). 12 sp. Afr., E. Ind., Austr. Leafless xerophytes with slightly fleshy stems.

**Sarothamnus** Wimm. = *Cytisus* Linn.

**Sarracenia** Linn. Sarraceniaceae. 6 sp. Atlantic N. Am. (side-saddle flowers), in sunny marshy places. Low herbs with rosettes of radical leaves ; each leaf is represented by a long narrow pitcher with a flat green wing of tissue on the ventral side, serving chiefly for assimilation. The general structure of the pitcher is closely similar to that found in *Nepenthes* ; it has a fixed lid projecting over the mouth, and the lip is usually turned down inwards. The mouth of the pitcher bears numerous honey-glands ; below these comes the 'slide-zone,' then the zone of hairs (cf. *Nepenthes*), and at the bottom is water in which the insects are drowned (see p. 196). The pitchers are often brightly coloured. It should be noted that in *S.* the entire leaf is transformed into a pitcher, while in *Nepenthes* it is only part of the leaf, and in *Cephalotus* only certain leaves. [See literature quoted on p. 205.]

**Sarraceniaceae**. Dicotyledons (Archichl. Sarraceniales). 3 gen. with 8 sp. Am. Insectivorous pitcher-plants (see gen.) with rosettes of radical leaves and  $\frac{1}{2}$  regular flrs. K 9—8—5, spiral, if  $> 5$  the outer 3 small ; C as many as inner sepals and alt. with them, or 0 ; A  $\infty$  ;  $\overline{G}$  (6—5—3) with  $\infty$  anatropous ovules on inrolled cpl.-walls.

Loculicidal capsule with  $\infty$  seeds; endosperm fleshy. *Genera*: *Heliamphora* (raceme; ovary 3-loc.), *Sarracenia* (flr. solitary; ovary 5-loc., the top of the pitcher simple), *Darlingtonia* (ditto, but the top of the pitcher is fish-tail-shaped). Placed in Parietales by Benth.-Hooker, in Cistiflorae by Warming.

**Sarraceniales.** The 13th cohort of Dicotyledons (p. 137).

**Sassafras** Linn. Lauraceae. 1 sp. Canada to Florida, *S. officinale* Nees et Eherm. (*Laurus Sassafras* L.). The wood and bark yield oil of sassafras, used in medicine.

**Satureia** Linn. Labiatae (VI. 11.) 130 sp., trop., subtrop. and warm temperate regions. The flrs. are gynodioecious. *S. hortensis* L. and *S. montana* L., the summer and winter savories respectively, are often grown as flavouring herbs.

**Satyrium** Linn. Orchidaceae (3). 60 sp. Cape Col., trop. Afr., E. Ind. The flr. is not twisted, so that the labellum stands uppermost; it is prolonged backwards into two spurs. The actual summit of the column is occupied by the stigma, the anther being bent round at right angles to it.

**Saurauia** Willd. Dilleniaceae. 60 sp. trop. As., Am.

**Sauromatum** Schott. Araceae (VII). 5 sp. trop. Afr., Himal. Leaves pedate (cymosely branched).

**Saururaceae.** Dicotyledons (Archichl. Piperales). 3 gen. with 4 sp. E. As. and N. Am. Herbaceous plants with  $\frac{1}{2}$  flrs., which are apparently primitively naked (see p. 59). Sta. 6 or fewer; cpls. 3—4 or (3—4), in the latter case with parietal placentae. Ovules orthotrous. Seeds with endo- and peri-sperm. *Chief genera*: *Saururus*, *Houttuynia*. United to Piperaceae by Benth.-Hooker.

**Saururus** Plum. ex Linn. Saururaceae. 1 sp. Japan to Philippine Is., 1 in U. S. Bog plants with spikes of flrs., the bract usually adnate to the axis of its flr.

**Saussurea** DC. Compositae (XI). 125 sp. N. temp. *S. alpina* DC. is an alpine sp. in Brit., with hairy leaves (p. 193); its flrs. are blue, with sweet scent (the latter unusual in the order). Many flrs. have 3 cpls.

**Sauvagesia** Linn. Ochnaceae. 10 sp. Brazil and 1 in all trop. regions. There are 5 fertile sta., surrounded by  $\infty$  staminodes. Cpls. 3. This genus and a few others are sometimes formed into a separate order, or placed (e.g. by Bentham and Hooker) in Violaceae.

**Savia** Willd. Euphorbiaceae (A. I. 1) 4 sp. W. Ind.

**Saxegothaea** Lindl. Coniferae (Taxac. 3; see C. for genus characters). 1 sp. Andes of Patagonia. Fruit a many-seeded 'berry' like that of *Juniperus*.

**Saxifraga** Linn. Saxifragaceae (I). 200 sp. N. temp., Arctic, Andes, chiefly alpine (p. 190). 13 sp. in Brit. (saxifrage). Most sp. show xerophytic characters, such as tufted growth, close packing of leaves (especially well shown in *S. oppositifolia* L.), succulence, hairiness, &c.

Many sp. are vegetatively propagated by offsets, or (e.g. *S. granulata* L.) by bulbils produced in the lower leaf-axils. Many exhibit chalk-glands at the tips or edges of the leaves (e.g. *S. oppositifolia* at the tip); these are water-pores (p. 117) with nectary-like tissue beneath, secreting water containing chalk in solution. As the water evaporates, the chalk forms an incrustation. The flrs. are usually in dichasial cymes with a cincinnus tendency. Every stage occurs in various sp. from hypogyny to epigyny (p. 67). The honey is only partially concealed, and the flrs. are visited by a miscellaneous lot of insects. Most sp. are protandrous. A few, e.g. *S. sarmentosa* Linn. f., have zygomorphic flrs. [For leaf-forms, see Jungner in *Bot. Notiser*, 1894—1895, reviewed in *Bot. Centr.* 62, 1895, p. 244.]

**Saxifragaceae.** Dicotyledons (Archichl. Rosales). 70 gen. with 600 sp. cosmop., chiefly temp. Most are perennial herbs, a few shrubs or trees, with usually alt., rarely stip. leaves. Many are alpine and arctic forms of xerophytic habit (p. 190). The infl. is of various kinds, both racemose and cymose.

Flr. usually ♂, regular, cyclic, 5-merous (except cpls.). The receptacle is flat or hollowed to various depths, so that the sta. and perianth may be peri- or epi-gynous. K usually 5; C 5, imbricate or valvate, sometimes (5) or 0; A usually 5 + 5, obdiplostemonous; cpls. rarely free and as many as petals, usually fewer and joined below, often 2; placentae parietal or axile, with several rows of anatropous ovules; styles as many as cpls. The flrs. are mostly protandrous. Fruit a capsule or berry. Seed with rich endosperm round a small embryo.

The S. are of little economic importance; *Ribes* yields valuable fruit. Many are favourites in horticulture, e.g. *Saxifraga*, *Francoa*, *Philadelphus*, *Deutzia*, *Hydrangea*, *Escallonia*.

*Classification and chief genera:*

- I. **SAXIFRAGOIDEAE** (herbs of various habit; leaves alt.; flrs. with 5- or rarely 4-merous perianth; cpls. usually 2; ovary hypo- or epi-gynous, 1- or 2-loc.): *Saxifraga*, *Tellima*, *Chrysosplenium*, *Parnassia*.
- II. **FRANCOIDEAE** (perennial herbs with radical leaves and flrs. in spikes or racemes on naked scapes; flr. 4-merous; ovary 4-loc.): *Francoa*.
- III. **HYDRANGEOIDEAE** (shrubs or trees; leaves usually opp., simple; perianth usually 5-merous; sta. epigynous; ovary 3—5-loc.): *Philadelphus*, *Deutzia*, *Hydrangea*.
- IV. **PTEROSTEMONOIDEAE** (shrubs with alt. stip. simple leaves; sta. 10; ovary inferior, 5-loc; ovules 4—6, on axile placentae): *Pterostemon*.
- V. **ESCALLONIOIDEAE** (shrubs or trees, rarely herbs; with simple alt. exstip. often leathery and gland-dotted leaves; sta. = petals; ovary superior to inferior; ovules ∞): *Brexia*, *Escallonia*.

VI. *RIBESIOIDEAE* (shrubs with alt. simple exstip. leaves and racemes of flrs.; ovary inferior, 1-loc. with 2 parietal placentae; berry): *Ribes*.

VII. *BAUEROIDEAE* (shrubs with opp. 3-foliate exstip. leaves and simple axillary flrs.; ovary semi-inferior with 2 parietal placentae; loculicidal capsule): *Bauera*.

[Placed in Rosales by Benth.-Hooker, in Saxifraginae by Warming.]

**Saxifrageae** (Benth.-Hooker) = Saxifragaceae.

**Saxifraginae** (Warming). The 18th cohort of Choripetalae (p. 146).

**Scabiosa** (Tourn.) Linn. (incl. *Knautia* Linn., *Ptercephalus* Vaill., *Succisa* Neck.). Dipsacaceae. 86 sp. Eur., As., Afr., esp. Medit.; 3 in Brit., of which *S. (K.) arvensis* L. (scabious) and *S. Succisa* L. (devil's-bit scabious) are common. The former has a large head of flrs.; the corolla of these is drawn out upon the outer side (cf. Compositae), and this the more the further they are from the centre of the head. Honey is secreted by the upper surface of the ovary, and protected from rain by hairs in the tube. The sta. are ripe first, while the style with immature stigmas is quite enclosed in the corolla; later the sta. wither and the style occupies their place. The stigmas of the various flowers upon the head ripen nearly simultaneously.

**Scaevola** Linn. Goodeniaceae. 60 sp. Austr., Polynes., coasts of trop. Afr., As., Am. *S. Koenigii* Vahl furnishes a kind of rice paper; its pith is squeezed flat like that of *Fatsia*.

**Scandix** Tourn. ex Linn. Umbelliferae (5). 12 sp. Eur., As., N. Afr. *S. Pecten-Veneris* L. (Venus' comb) in Brit. The ripe mericarps separate with a violent jerk.

**Scirpochzeria** Linn. Juncaginaceae. 1 sp., *S. palustris* L., N. temp. and arctic, incl. Brit.; a marsh plant.

**Schinus** Linn. Anacardiaceae (III). 4 sp. Mexico to Argentina. *S. Molle* L. yields American mastic (resin).

**Schismatoglottis** Zoll. et Mor. Araceae (v). 10 sp. Malaya. At the top of the spadix, above the ♂ flrs., are sterile flrs. consisting of staminodes.

**Schivereckia** Andr. = *Alyssum* Tourn.

**Schizaea** Sm. Schizaeaceae. 16 sp. trop. and subtrop. The sporangia form a double row on the lower surface of each of the reduced fertile pinnae.

**Schizaeaceae**. Filicinae Leptosporangiatæ (Homosporous). 5 gen. with 70 sp., chiefly trop. Am.; a few subtrop. or temp. They are mostly small ferns with but little stem. *Lygodium* is a curious leaf-climber. As in *Osmunda*, the sporangia are borne (exc. in *Mohria*) on special pinnae of the leaf, distinct from the ordinary vegetative pinnae. The sporangia are sessile, usually without indusium; at the apex is a cap-like annulus, and the sporangium dehisces longitudinally. Chief genera: *Schizaea*, *Aneimia*, *Lygodium*, *Mohria*.

**Schizandra** Michx. Magnoliaceae (2). 7 sp. trop. and warm temp. As.;

- S. coccinea* Michx. in Atlantic N. Am. Climbing shrubs with exstip. leaves and spiral flrs.
- Schizanthus** Ruiz et Pav. Solanaceae (v). 11 sp. Chili. The flr. is zygomorphic; the stalk is curved, and the two really upper petals form the lower lip which is 3—4-lobed, while the lateral petals are 4-lobed and the lowest petal forms the simple or slightly 2-lobed upper lip. Sta. 4, 2 fertile and 2 staminodial. The flr. has a good general likeness to that of the papilionate Leguminosae (cf. *Collinsia*), and is fertilised in a very similar way, usually by an explosive movement of its parts (cf. *Genista*).
- Schizopetalon** Sims. Cruciferae (III. 12). 5 sp. Chili.
- Schizostigma** Arn. Rubiaceae (1. 7). 1 sp. Ceylon. Ovary 5—7-loc.
- Schizostylis** Backh. et Harv. Iridaceae (III). 2 sp. S. Afr. *S. coccinea* Backh. et Harv. is often cultivated for its handsome flrs.
- Schkuhria** Roth. Compositae (VI). 11 sp. W. Am.
- Schlechtendalia** Less. Compositae (XII). 1 sp. Brazil. A plant of very unusual habit (for this order), and with peculiar anatomy (see *Ber. D. Bot. Ges.* II. 1884, p. 100).
- Schleichera** Willd. Sapindaceae (I). 1 sp. trop. As., *S. trijuga* Willd. It furnishes a useful timber; the aril of the seed is edible, and an oil is expressed from the seed itself.
- Schoenocaulon** A. Gray. Liliaceae (I). 5 sp. Am. Veratrin is made from the seeds.
- Schoenus** Linn. Cyperaceae (II). 70 sp. Austr., a few in Afr., Am., Eur.; *S. nigricans* L. in Brit.
- Schollera** Roth = *Vaccinium* Linn.
- Schomburgkia** Lindl. Orchidaceae (13). 12 sp. trop. Am.
- Schotia** Jacq. (*Theodora* Medic.). Leguminosae (II. 3). 6 sp. trop. and S. Afr.
- Schubertia** Mart. = *Araujia* Brot.
- Sciadopitys** Sieb. et Zucc. Coniferae (Arauc. 1 c; see C. for genus characters). 1 sp. Japan, *S. verticillata* Sieb. et Zucc., the parasol-pine or umbrella-fir, planted round the temples. The short shoots are crowded together at the ends of the annual long shoots. Each short shoot resembles that of *Pinus* except that the two green needle-leaves are 'fused' together into a single needle grooved down the centre, so that at first glance in *S.* the short shoots seem to be whorls of ordinary leaves at the tip of each year's growth. The cones take two years to ripen. The wood is useful for waterworks &c.
- Scilla** Linn. Liliaceae (v). 80 sp. Old World temp. *S. festalis* Salisb. (*S. nutans* Sm.), wild hyacinth or English bluebell, and others in Brit. Bulbous plants with racemes of flrs.
- Scirpus** (Tourn.) Linn. Cyperaceae (1). 200 sp. cosmop. in bogs and marshes; 15 in Brit. The stem is usually erect and angular, bearing 3 ranks of leaves reduced to sheaths, and performs the work of assimilation. Its base often gives rise to creeping rhizomes or to



shoots ending in tubers like potatoes. The racemose many-flowered spikelets are aggregated into a terminal tuft. The flr. is ♀, and has 6 perianth-scales in two whorls; in many sp. it is protogynous; in all it is wind-pollinated. *S. lacustris* L., sometimes termed the bulrush, is used for matting, chair-seats, &c.

**Scitamineae.** The 9th cohort (Engler) of Monocotyledons (p. 135). An order (Benth.-Hooker) in series Epigynae, including Musaceae, Marantaceae, Cannaceae, and Zingiberaceae of Engler. The 6th cohort (Warming) of Monocotyledons (p. 146).

**Scleranthaceae** or Illecebraceae. See Caryophyllaceae.

**Scleranthus** Linn. Caryophyllaceae (II. 6). 10 sp. Eur., As., Afr.; *S. annuus* L. (Knapweed) and another in Brit. Flrs. apetalous, self-fertilising.

**Scleria** Berg. Cyperaceae (II). 100 sp. trop. and warm temp.

**Sclerochloa** Beauv. Gramineae (X). 1 sp. Eur., As.

**Scoliopus** Torr. Liliaceae (VII). 2 sp. West N. Am.

**Scolopendrium** Sm. Polypodiaceae. 10 sp. trop. and temp., esp. N. Hemisphere. *S. vulgare* Sm. (hart's tongue fern) in Brit.

**Scolymus** Tourn. ex Linn. Compositae (XIII). 3 sp. Medit.

**Scopolia** Jacq. Solanaceae (II). 4 sp. Eur., As.

**Scorpiurus** Linn. Leguminosae (III. 7). 6 sp. Medit. The pod is twisted and indehiscent; often it looks like a caterpillar, and it has been suggested that birds are deceived by this and carry it to a distance before discovering the mistake.

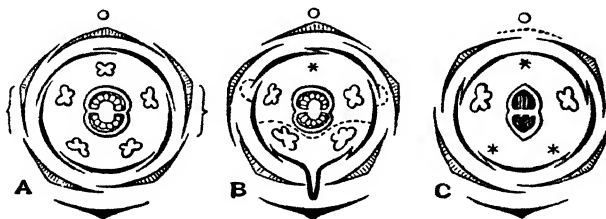
**Scorzonera** (Tourn.) Linn. Compositae (XIII). 100 sp. N. temp. Old World. Like Taraxacum. The roots of *S. hispanica* L. and others are eaten as vegetables.

**Scrophularia** Tourn. ex Linn. Scrophulariaceae (II. 6). 115 sp. N. temp.; 3 in Brit.; *S. aquatica* L. and *S. nodosa* L., the fig-worts, are common. Perennial herbs with opp. leaves, which on the lateral twigs are commonly anisophyllous (p. 38). The flrs. are in tall infls. whose primary branching is racemose; the lateral shoots are dichasial. The flr. has the sta. and style arranged along the lower lip of the corolla, instead of the upper, as is usually the case in such flrs. Correlated with this is the fact that the posterior sta., usually absent in the order, is represented by a staminode, as it is not in the way of insects entering the flr. (it is entirely aborted in flrs. which have the essential organs under the upper lip). The flr. is markedly protogynous, and is largely visited by wasps and but rarely by other insects. The peculiar brown colour may perhaps be due to the selection of wasps; but there are so few wasp-flowers that it is impossible to draw any conclusions upon the subject (see *Cotoneaster* and *Epipactis*).

**Scrophulariaceae.** Dicotyledons (Sympet. Tubiflorae). About 180 gen. with 2000 sp., cosmop. Most are herbs and undershrubs, a few shrubs or trees (e.g. *Paulownia*), with alt., opp., or whorled exstip. leaves. Many exhibit interesting features in the vegetative organs.

Several are climbers (e.g. *Maurandia*, *Rhodochiton*, &c.). The *Veronicas* of N. Z. are interesting xerophytes with remarkable resemblance in habit to certain *Coniferae*. A considerable number of sp. in tribes 11 and 12 (below), e.g. *Euphrasia*, *Bartsia*, *Pedicularis* &c., are semi-parasitic (p. 194). They mostly grow in swampy grass-land and are parasitic by their roots upon the roots of the grasses. Suckers are formed at the points of contact. "The formation of the suckers occurs in spring; the absorption of organic food by their means from living parts of plants lasts into the summer; at this period the haustoria contain but little starch. In late summer and autumn an absorption of organic compounds from the dead parts of the host takes place. At this period, and later, the haustoria function as places for storage of reserve-materials" (von Wettstein). The plants possess green leaves of their own, and so are able to assimilate.

The infl. may be racemose or cymose. In the former case it is usually a spike or raceme, axillary or terminal (every variety may be



Floral diagrams of A, *Verbascum nigrum*, B, *Linaria vulgaris*, C, *Veronica Chamaedrys*; after Eichler.

found in sp. of *Veronica*). Solitary axillary fls. occur in many S., e.g. *Linaria*. The cymose infls. are usually dichasia, often united into complex corymbs &c. Bracts and bracteoles are usually present. In *Castilleja* the upper leaves and bracts are brightly coloured.

The flr. is ♀, zygomorphic, sometimes nearly regular (*Verbascum* &c.), and shows considerable variety in structure, as is illustrated by the floral diagrams given. The bulk of the order show the *Linaria* type. K (5), of various aestivations; C (5), median-zygomorphic, often 2-lipped; A 4 (sometimes 2), didynamous, epipetalous, the posterior sta. sometimes represented by a staminode (e.g. in *Scrophularia* and *Pentstemon*). *Verbascum* and its allies have an actinomorphic corolla and 5 sta.; *Veronica* (q.v.) shows 4 sepals (the posterior one of the typical 5 being absent), 4 petals (the posterior pair of the 5 united), and 2 sta., the corolla being rotate in form. Other variations occur in the *Selaginiae* &c. Below the ovary is a honey-

secreting disc.  $\underline{G}$  (2), medianly placed (not obliquely as in Solanaceae), 2-loc., with axile placentae. Ovules usually  $\infty$ , less commonly few (e.g. *Veronica* &c.), anatropous. Style simple or bilobed. Fruit surrounded below by the persistent calyx, usually a capsule (dehiscent in various ways) or a berry. Seeds usually numerous, small, with endosperm. Embryo straight or slightly curved.

Most of the order have flrs. more or less adapted to insect-visits. Müller divides them into 4 types: (1) the *Verbascum* or *Veronica* type (see genera) with open flr. and short tube (bees and flies), (2) the *Scrophularia* type (wasps), (3) the *Digitalis* and *Linaria* type with long wide tubes and the essential organs so placed as to touch the back of the insect (bees), and (4) the *Euphrasia* type or 'loose-pollen' flr. (p. 91), where the pollen is loose and powdery, and the anthers (protected by the upper lip of the flr.) are provided with spines &c., so that they may be shaken upon the entrance of the insect, which thus receives a shower of pollen on its head. The flrs. are seldom markedly dichogamous, but the stigma usually projects beyond the sta. so as to be first touched by a visitor. Most of the flrs. are capable of self-fertilisation in default of insect-visits. For further details see genera.

In *Linaria* &c. (q.v.) there sometimes appears a terminal flr. to the raceme, and this exhibits the phenomenon of *peloria*, having a symmetrical corolla with spurs to all the petals (cf. *Ruta*, or compare *Aquilegia* with *Delphinium*).

A number of the S. are or have been officinal e.g. *Digitalis*; most of them are poisonous. Many are favourite garden and greenhouse plants, e.g. *Calceolaria*, *Mimulus*, *Pentstemon*, *Antirrhinum*, *Linaria*, *Veronica*, *Collinsia* &c.

*Classification and chief genera* (after von Wettstein):

A. The two posterior corolla-teeth (or the upper lip) cover the lateral teeth in bud.

I. *PSEUDOSOLANEAE* (all leaves usually alt.; 5 sta. often present):

1. *Verbasceae* (corolla with very short tube or none, rotate or shortly campanulate): *Verbascum*, *Celsia*.
2. *Aptosimeae* (corolla with long tube): *Aptosimum*.

II. *ANTIRRHINOIDEAE* (lower leaves at least opp.; the 5th sta. wanting or staminodial):

- a. Corolla 2-lipped; lower lip concave, bladder-like.
4. *Calceolarieae*: *Calceolaria*.
- β. Corolla almost actinomorphic, or 2-lipped with flat or convex lips.
3. *Hemimerideae* (dehiscent capsule; corolla spurred or saccate at base, with no tube): *Alonsoa*.
5. *Antirrhineae* (as 3, but with tube): *Linaria*, *Antirrhinum*, *Maurandia*, *Rhodochiton*.

6. *Cheloneae* (dehiscent capsule or many-seeded berry; corolla not spurred or saccate; infl. cymose, compound): *Russelia*, *Wightia*, *Collinsia*, *Scrophularia*, *Chelone*, *Pentstemon*, *Paulownia*.
7. *Manuleae* (dehiscent capsule; corolla as in 6; infl. not cymose, usually simple; anthers finally 1-loc.): *Zaluzianskia*, *Lyperia*.
8. *Gratiolaeae* (as 7, but anthers finally 2-loc.): *Mimulus*, *Gratiola*, *Torenia*.
9. *Selagineae* (fruit a drupe or an indehiscent few-seeded capsule): *Hebenstretia*, *Selago*.

B. The two posterior teeth (or the upper lip) of the corolla covered in bud by one or both of the lateral teeth.

### III. RHINANTHOIDEAE.

- a. Corolla-teeth all flat and divergent, or the 2 upper erect.
  10. *Digitaleae* (anther-loc. finally united at tip; the 2 upper corolla-lobes often erect; not parasitic): *Veronica*, *Digitalis*.
  11. *Gerardiaceae* (anther-loc. always separate, one often reduced; corolla-lobes all flat, divergent; often parasitic): *Gerardia*.
- b. The 2 upper corolla-teeth form a helmet-like upper lip. Often parasitic.
  12. *Rhinanthaeae*: *Castilleja*, *Melampyrum*, *Tozzia*, *Euphrasia*, *Bartsia*, *Pedicularis*, *Rhinanthus*.

[Benth.-Hooker exclude from S. the 9th tribe, which they unite with Globulariaceae to form a separate order Selagineae, placed in Lamiales; the rest of the order they place in Personales. Warming following Eichler places the order in Personatae, excluding the *Selagineae*, which are placed as a separate order (Selaginaceae, not united to Globulariaceae), in Nuculiferae.]

**Scrophularineae** (Benth.-Hooker) = Scrophulariaceae.

**Scutellaria** Riv. ex Linn. Labiatae (IV). 180 sp. cosmop. exc. S. Afr. 2 in Brit., *S. galericulata* L. and *S. minor* Huds. (skull-cap).

**Scuticaria** Lindl. Orchidaceae (27). 2 sp. trop. Am. Epiphytes, with no tubers, but long pendulous fleshy cylindrical stems.

**Scyballium** Schott et Endl. Balanophoraceae. 4 sp. trop. Am.

**Seaforthia** R. Br. = Ptychosperma Labill.

**Secale** (Tourn.) Linn. Gramineae (XII). 2 sp. Medit., Eur., As. *S. cereale* L., the rye, is largely cultivated in Germany, Russia, &c., as a cereal, forming a staple food.

**Secamone** R. Br. Asclepiadaceae (II. 3). 24 sp. trop. Afr., As., Austr.

**Sechium** P. Br. Cucurbitaceae (IV). 1 sp. trop. Am., *S. edule* Sw., largely cultivated for its edible fruit (choco), containing one enormous seed which germinates within the fruit.

**Securidaca** Linn. Polygalaceae. 30 sp. trop., except Austr.

**Securigera** DC. Leguminosae (III. 5). 1 sp. Medit.

**Securinega** Comm. ex Juss. Euphorbiaceae (A. 1. 1). 10 sp. temp. and subtrop.

**Sedum** Tourn. ex Linn. Crassulaceae. 140 sp. N. temp., 1 in Peru; 9 in Brit., incl. *S. Telephium* L. (orpine or livelong), *S. Rhodiola* DC. (rose-root), *S. anglicum* Huds. and *S. acre* L. (stonecrop or wall-pepper). Fleshy-leaved xerophytes.

**Segueria** Loeffl. Phytolaccaceae. 8 sp. S. Am. Leaves leathery; stipules thorny. The plants have a powerful odour of garlic. Cpl. 1. The fruit is a samara, closely resembling one half of that of *Acer* or many *Malpighiaceae*.

**Selaginiae** (Benth.-Hooker). See *Scrophulariaceae*.

**Selaginella** Spring. The only genus of *Selaginellaceae*. 350 sp. chiefly trop. A few are temp. e.g. *S. selaginoides* Link on boggy hill sides in Brit. Most of the sp. live in damp places, especially in forests, but there are a few xerophytes. The embryo is provided with a suspensor, and grows directly into the leafy plant, which shows a habit very similar to that of *Lycopodium*—much-branched stem, often creeping, bearing roots on the lower side and leaves on the upper, with terminal cones of sporangia. The leaves may be spirally arranged as in most sp. of *Lycopodium* (e.g. in *S. selaginoides*), or more commonly they form 4 ranks, two outer ones of large, two inner of small leaves, thus giving the stem a dorsiventral structure. The roots in some sp., e.g. *S. Kraussiana* A. Br. and *S. Martensii* Spring, are borne on *rhizophores*, anomalous stem branches developed at the nodes and exhibiting a sort of intermediate structure between stem and root. The sporangia are placed at the bases of the leaves in terminal cones, which exhibit radial symmetry. The mega-sporangia contain 4 large spores and can easily be distinguished by the naked eye from the micro-sporangia. On germination a microspore produces a rudimentary male prothallus bearing an antheridium. The megaspore forms a female prothallus, which remains enclosed in the burst spore, and has an upper small-celled green portion and a lower large-celled storage portion as in *Salvinaceae* &c.

*S. lepidophylla* Spring is a curious little xerophyte which curls up into a ball in the dry season, and may be rolled about by the wind (compare *Anastatica*).

**Selaginellaceae**. *Lycopodiinae* (Heterosporous). Only genus *Selaginella* (q.v.).

**Selago** Linn. *Scrophulariaceae* (II. 9). 80 sp. S. Afr., Madagascar.

**Sclenopodium** Rchb. f. *Orchidaceae* (2). 2 sp. Panama, Guiana. Like *Cypripedium*, but ovary 3-loc.

**Selinum** Linn. *Umbelliferae* (6). 25 sp. N. Hemisph., S. Afr.

**Selliera** Cav. *Goodeniaceae*. 2 sp. Austr.

**Semecarpus** Linn. f. *Anacardiaceae* (IV). 40 sp. Ceylon to Austr.

**Semele** Kunth. *Liliaceae* (VII). 1 sp. Canaries, *S. androgyna* Kunth (*Ruscus androgynus* L.). A climbing shrub with leaf-like phylloclades

in the axils of scale-leaves. Flrs. in little cymes (cf. *Asparagus*) on the edges of the phylloclades. The new shoots rise from the soil, and grow to a considerable length before the lateral branches, bearing the phylloclades, begin to unfold.

**Sempervivum** Rupp. ex Linn. Crassulaceae. 50 sp. mts. of S. Eur., Himal., Abyss., &c. *S. tectorum* L., the houseleek, often planted on cottages to keep the slates in position, is a xerophyte with fleshy leaves and much vegetative multiplication by offsets.

**Senebiera** DC. (*Coronopus* Rupp.). Cruciferae (II. 5). *S. didyma* Pers. naturalised in Brit.

**Senecio** (Tourn.) Linn. (incl. *Cacalia* Linn., *Cineraria* Linn., *Kleinia* Haw., *Ligularia* Cass., &c.). Compositae (VIII). 1250 sp. cosmop. 9 in Brit. (ragwort, groundsel, &c.). The genus includes plants of the most various habit. Some are climbers, e.g. *S. macroglossus* DC. (S. Afr.), which is remarkably like ivy in habit. Many are xerophytes, some with fleshy leaves, others with fleshy stems, others with hairy or inrolled leaves (cf. *Empetrum*). The flrs. of *S. vulgaris* L. (groundsel) are regularly self-fertilised, and are very inconspicuous; there are no ray-florets. In *S. Jacobaea* L. (rag-wort) there are ray-florets, and the conspicuous flrs. are largely visited by insects. A very interesting sp. is *S. (K.) articulatus* Sch. Bip. (S. Afr.), whose fleshy stems easily separate at the joints and grow into new plants.

**Sequoia** Endl. (*Wellingtonia* Lindl.) Coniferae (Arauc. 1 c.; see C. for genus characters). 2 sp. N.W. Am. *S. gigantea* Lindl. et Gord is the mammoth tree of Calif., discovered in the Sierra Nevada in 1850. Some specimens are more than 300 feet high and 36 feet thick, second only in size to the Eucalyptus; the age of the largest is about 1500 years. In most museums in Brit. there are sections of a tree cut down in 1882 and showing 1335 annual rings. *S. sempervirens* Endl., the redwood, is also a gigantic tree, and is valued for its timber &c.

**Serapias** Linn. Orchidaceae (3). 5 sp. Medit.

**Sericocarpus** Nees. Compositae (III). 5 sp. U. S.

**Serjania** Plum. ex Schum. Sapindaceae (I). 172 sp. trop. and subtrop. Am. Lianes with watch-spring tendrils and stip. leaves. Fruit a 3-winged schizocarp.

**Serratula** Dill. ex Linn. Compositae (XI). 40 sp. Eur. to Japan. *S. tinctoria* L. (saw-wort) in Brit.; it is dioecious.

**Serruria** Salisb. Proteaceae (I) 50 sp. S. Afr.

**Sesamum** Linn. Pedaliaceae. 12 sp. trop. Afr., As. *S. indicum* L. is largely cultivated in India &c. for the oil expressed from its seeds (gingili, gingelly, sesame, &c.).

**Sesbania** Scop. Leguminosae (III. 6). 20 sp. trop. and subtrop. *S. aculeata* Poir. is a marsh plant, giving off floating roots from the base of the stem, covered with a spongy aerenchyma (p. 172, and cf. *Neptunia*).

- Seseli** Linn. Umbelliferae (6). 60 sp. Eur., N. Afr., As. *S. Libanotis* Koch in Brit.
- Sealeria** Scop. Gramineae (x). 10 sp. Eur., W. As., mostly alpine. *S. coerulea* Arduin. in Brit.
- Sesuvium** Linn. Aizoaceae (II. 1). 5 sp. trop. and subtrop. Halophytes (p. 187).
- Setaria** Beauv. Gramineae (v). 12 sp. trop. and warm temp. *S. italica* Beauv. (Italian millet) is cultivated as a cereal in E. As.
- Shepherdia** Nutt. Elaeagnaceae. 3 sp. N. Am. The receptacle becomes fleshy in fruit. The fruit of *S. argentea* Nutt. (buffalo-berry) is edible.
- Sherardia** Dill. ex Linn. Rubiaceae (II. 21). 1 sp. Eur. (incl. Brit.), W. As., N. Afr., *S. arvensis* L., the field madder.
- Shorea** Roxb. Dipterocarpaceae. 87 sp. Ceylon to Philippine Is. *S. robusta* Gaertn. f. (sal) is a most valuable timber tree, with wood like that of teak, and is largely grown in India.
- Shortia** Torr. et Gray. Diapensiaceae. 1 sp. N. Carolina, 1 sp. Japan (cf. *Epigaea*).
- Sibbaldia** Linn. = *Potentilla* Linn. *S. procumbens* L. = *P. Sibbaldi*.
- Sibthorpia** Linn. Scrophulariaceae (III. 10). 6 sp. Eur., Medit., Nepal, Andes. *S. europaea* L. (Cornish money-wort) in S. England.
- Sicyos** Linn. Cucurbitaceae (IV). 30 sp. trop. Am., Polynes., Austr. Some sp. have hooked fruits.
- Sida** Linn. Malvaceae (II). 70 sp. Am., Austr., 1 Eur., several in all trop. lands.
- Sidalcea** A. Gray. Malvaceae (II). 10 sp. N.W. Am.
- Sideritis** Tourn. ex Linn. Labiatae (VI. 1). 45 sp. Medit., Orient.
- Sideroxylon** (Dill.) Linn. Sapotaceae (1). 80 sp. trop.
- Siegesbeckia** Linn. Compositae (v). 4 sp. trop. and warm temp. The heads are small, with an involucre of 5 bracts, covered with very sticky glandular hairs. The secretion continues till after the fruit is ripe, and aids in its distribution, the whole head breaking off and clinging to a passing animal.
- Silaus** Bernh. Umbelliferae (6). 2 sp. Eur., Siberia (1 Brit.).
- Silene** Linn. Caryophyllaceae (I. 1). 300 sp. N. temp, esp. Medit. (7 in Brit.). The flrs. of many sp. are adapted to pollination by butterflies, e.g. those of *S. acaulis* L. (moss-campion, a tufted alpine plant); others are pollinated by moths, e.g. *S. inflata* Sm. (bladder campion), which emits its scent at night (p. 103).
- Siler** Crantz. Umbelliferae (6). 2 sp. Eur., Siberia.
- Silphium** Linn. Compositae (v). 12 sp. eastern U.S. *S. laciniatum* L. is the famous 'compass-plant' of the prairies. If growing in an exposed position its leaves turn their edges to north and south. They thus avoid the excessive mid-day radiation, and get the full benefit of the morning and evening sun. (Cf. *Lactuca*.)
- Silybum** Vaill. ex Adans. Compositae (XI). 2 sp. Medit. *S. Maria-*

*num* Gaertn. (milk-thistle) in Brit. It is now widely distributed over the Pampas, where it was introduced.

**Simaruba** Aubl. Simarubaceae. 6 sp. trop. Am.

**Simarubaceae.** Dicotyledons (Archichl. Geraniales). 28 gen. with 124 sp. trop. and subtrop. Shrubs and trees with alt. pinnate or simple leaves, never gland-dotted. Flrs. small, regular, ♂, often ∞, in axillary compound panicles or cymose spikes. Flr. with K and C 3—7-merous. K free or more often united; C imbricate or rarely valvate; disc between sta. and ovary ring- or cup-like, sometimes enlarged into a gynophore; sta. twice as many as petals, obdiplostemonous, often with scales at the base; cpls. (4—5) or less, often free below and united by the style or stigma; ovules usually 1 in each loc. as in Rutaceae. Schizocarp or capsule; endosperm thin or none; embryo with thick cotyledons. A few yield useful timber. *Chief genera:* Simaruba, Ailanthus. Placed in Geraniales by Benth.-Hooker, in Terebinthinae by Warming.

**Simarubeae** (Benth.-Hooker) = Simarubaceae.

**Simethis** Kunth. Liliaceae (111). 1 sp. Brit., W. and S. Eur., S. *bicolor* Kunth.

**Sinapis** Linn. = Brassica Tourn.

**Sinningia** Nees. Gesneriaceae (11). 20 sp. Brazil. *S. speciosa* Hiern and others are favourite hot-house plants (generally known as Gloxinias). They are tuberous plants. The usual method of propagation is by planting leaves on the soil; from the base of the petiole a new plant arises by budding (cf. Begonia and Streptocarpus).

**Siphocampylus** Pohl. Campanulaceae (111). 100 sp. trop. Am.

**Siphonia** Rich. = Hevea Aubl.

**Sison** Linn. Umbelliferae (5). 1 sp. Eur., incl. Brit.

**Sisymbrium** (Tourn.) Linn. (incl. *Alliaria* Adans.). Cruciferae (11. 8). 50 sp. N. temp.; 3 in Brit., incl. *S. officinale* Scop. (hedge-mustard).

**Sisyrinchium** Linn. Iridaceae (11). 50 sp. Am.

**Sium** (Tourn.) Linn. Umbelliferae (5). 6 sp. N. Hemisph., S. Afr. 2 in Brit. (water-parsnip). *S. Sisarum* L. (skirret) is sometimes cultivated for its tuberous roots, which are boiled and eaten.

**Skimmia** Thunb. Rutaceae (1X). 4 sp. Himal., Japan. *S. japonica* Thunb. is often cultivated for its handsome foliage and red berries.

**Sloanea** Linn.. Elaeocarpaceae. 44 sp. trop.

**Smilacina** Desf. Liliaceae (VII). 20 sp. N. temp.

**Smilax** (Tourn.) Linn. Liliaceae (XI). 200 sp. chiefly trop.; also in E. As., N. Am., Medit. Most are climbing shrubs with net-veined leaves. At the base of the leaf spring two tendrils, one on either side, usually regarded as modified stipules, though these organs scarcely occur in Monocotyledons. The stems are often furnished with recurved hooks which aid in climbing. Flrs. dioecious, in umbels. The dried roots of several S. Am. sp. form sarsaparilla.



**Smithia** Ait. Leguminosae (III. 7). 30 sp. trop. As. Afr.

**Smithiantha** O. Ktze. = *Naegelia* Regel.

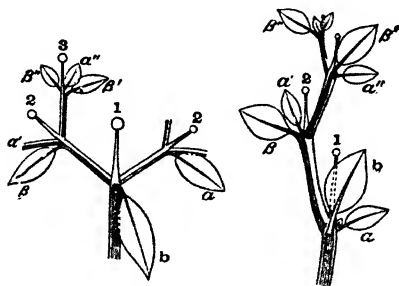
**Smyrniun** (Tourn.) Linn. Umbelliferae (5). 1 sp. Medit., Eur., Brit.,

*S. Olusatrum* L. (Alexanders), formerly used like celery.

**Sobralia** Ruiz et Pav. Orchidaceae (14). 30 sp. trop. Am.

**Soja** Moench = *Glycine* Linn.

**Solanaceae.** Dicotyledons (Sympet. Tubiflorae). 72 gen. with 1500 sp. trop. and temp.; the chief centre is Cent. and S. Am., where there are 36 local genera; in Eur. and As. only sub-order II. is represented. Herbs shrubs or small trees; leaves in the non-flowering part usually alt., but in the infl. portion alt. or in pairs; the arrangement in pairs is due to the mode of branching and adnation (p. 34), as illustrated in the figure. In *Datura* the branching is dichasial, and the bracts are adnate to their axillary shoots up to the point at which the



Branching in Solanaceae (after Eichler); *Datura Stramonium* (left) and *Atropa Belladonna* (right) 1, 2, 3, flrs. or infls. of successive orders; *b*, bract of 1, *α* *β* bracts of 2, and so on.

next branches arise, so that *α* looks like the bracteole of 2, rather than its bract. In *Atropa* the branching is cincinnal, one of the two branches at a node remaining undeveloped, and the bract is again adnate to its axillary branch. Of the pair of leaves thus found at any node, one is usually smaller than the other. In *Solanum* and others further complications occur (see Eichler's *Blüthendiag.*).

Flrs. solitary or in cymes, ♂, sometimes zygomorphic. K (5), persistent; C (5), of various forms, rarely 2-lipped, usually folded and convolute; A 5, alt. with petals, epipetalous, or fewer in zygomorphic flrs.; G (2), obliquely placed in the flr. (the posterior cpl. to the right, the anterior to the left, when shown in a floral diagram), 2-loc., sometimes with secondary divisions (e.g. *Datura*), upon a hypogynous disc; ovules 1—∞ in each loc., anatropous or slightly amphitropous, on axile placentae (most often the placentae are swollen and the ovules numerous); style simple, with 2-lobed stigma. Berry

or capsule. Embryo curved or straight, in endosperm. The flrs. are conspicuous and insect-visited; some, e.g. *Nicotiana*, are adapted to Lepidoptera. A few are economically important, e.g. *Solanum* (potato), *Nicotiana* (tobacco), *Lycopersicum*, *Capsicum*, &c.; *Datura*, *Atropa*, &c. are medicinal; several are favourites in horticulture.

*Classification and chief genera* (after von Wettstein): the *S.* are nearly related to Scrophulariaceae, the most general distinction being the oblique ovary; this however is by no means easily made out, and the zygomorphism of the flr. is most often used as a distinction. Certain genera of *S.* are nearly related to various Boraginaceae, Gesneriaceae, Nolanaceae, &c., and it is quite possible that the *S.* are not really a simple family (see *Nat. Pfl.*); they occupy a middle place between the Tubuliflorae with actinomorphic, and those with zygomorphic flrs.

A. Embryo clearly curved, through more than a semicircle. All 5 sta. fertile, equal or only slightly different in length.

I. *NICANDREAE* (ovary 3—5-loc., the walls of the loc. dividing the placentae irregularly): *Nicandra* (only genus).

II. *SOLANEAE* (ovary 2-loc.): *Lycium*, *Atropa*, *Hyoscyamus*, *Physalis*, *Capsicum*, *Solanum*, *Lycopersicum*, *Mandragora*.

III. *DATUREAE* (ovary 4-loc., the walls dividing the placentae equally): *Datura*, *Solandra* (only genera).

B. Embryo straight or slightly curved (less than a semicircle).

IV. *CESTREAE* (all 5 sta. fertile); *Cestrum*, *Nicotiana*, *Petunia*.

V. *SALPIGLOSSIDEAE* (2 or 4 sta. fertile, of different lengths): *Salpiglossis*, *Schizanthus*.

[Placed in Polemoniales by Benth.-Hooker, who unite Nolanaceae to *S.*; in Personatae by Warming.]

***Solanum*** (Tourn.) Linn. (excl. *Lycopersicum* Hill). Solanaceae (II). 900 sp. trop. and temp. *S. Dulcamara* L. (bittersweet, nightshade) and *S. nigrum* L. in Brit. The flrs. are small, with a cone of anthers opening at the tip as in *Borago*. *S. tuberosum* L. (S. Am.) is the potato. From the axils of the lowest leaves there spring branches which grow horizontally underground and swell up at the ends into tubers (potatoes). That these are stem structures and not roots is shown by their origin and by their possession of buds—the ‘eyes.’ Each eye is a small bud in the axil of an aborted leaf (represented by a semicircular rim). When the parent plant dies down in autumn the tubers become detached, and in the next season they form new plants by the development of the eyes, at the expense of the starch and other reserves stored in the tuber (see p. 163). By heaping earth against the stem, so as to cover more of the leaf-axils, more of the axillary shoots are made to become tuber-bearing; hence the value of ridging potatoes. *S. Melongena* L., the egg-fruit, is cultivated in the

- tropics for its edible fruit. [For *S. Lycopersicum* L. (tomato) see *Lycopersicum*.]
- Soldanella** Linn. Primulaceae (I). 4 sp. Alps of Eur. (p. 159). The fls. expand at very low temperatures, often coming up through the snow; they have a mechanism like that of *Erica*.
- Solenanthus** Ledeb. Boraginaceae (IV. 1). 15 sp. Medit., As.
- Solidago** (Vaill.) Linn. Compositae (III). 80 sp. Am.; 1 in Eur. (incl. Brit.), *S. Virgaurea* L., the golden rod.
- Sollya** Lindl. Pittosporaceae. 2 sp. W. Austr. Twiners.
- Sonchus** (Tourn.) Linn. Compositae (XIII). 45 sp. Old World; 3 in Brit. (sow-thistle). Like *Hieracium*.
- Sonerila** Roxb. (*Cassebeeria* Dennst.) Melastomaceae (I). 60 sp. Indo-mal., China.
- Sonneratia** Linn. f. (*Blatti* Adans.). Blattiaceae. 6 sp. Indo-mal. Mangroves (p. 189), with the general habit of *Rhizophoraceae*. Aerial roots spring vertically out of the mud, arising as lateral, negatively geotropic branches upon the ordinary roots; they are provided with aerenchyma (p. 189), and appear to be respiratory organs (see Goebel, *Ber. D. Bot. Ges.* IV, 1886, p. 249 and *Pflanzenbiol. Sch.* I, p. 139).
- Sophora** Linn. Leguminosae (III. 1). 25 sp. trop. and warm temp. Winter-buds naked. The wood is very hard.
- Sophrontitis** Lindl. Orchidaceae (13). 4 sp. Brazil, epiphytic.
- Sorbus** (Tourn.) Linn. = *Pyrus* Tourn.
- Sorghum** Linn. (incl. in *Andropogon* in *Nat. Pfl.*). Gramineae (II). 13 sp. trop. and subtrop. The chief is *S. vulgare* Pers., the millet or guinea corn, largely cultivated in the Medit. region &c. as a cereal. From the halm of the var. *saccharatum* Koern. sugar is sometimes prepared.
- Spadiciflorae** (Warming). The 3rd cohort of Monocotyledons (p. 146).
- Sparganiaceae**. Monocotyledons (Pandanales). Only genus *Sparganium* (q.v.). United to *Typhaceae* by Benth.-Hooker and Warming.
- Sparganium** (Tourn.) Linn. Sparganiaceae. 9 sp. N. temp., Austr., N.Z.; 3 in Brit. (bur-weed), in shallow ponds. There is a creeping rhizome and a stem projecting above water with the leaves and fls. These are in spherical heads, the ♂ heads usually higher up the axis than the ♀. Each flr. has P 3—6, scaly, sepaloid; the ♂ has 3—6 sta., alt. with P. when equal in number; the ♀ has 1 or (2) cpls.; ovule 1, pendulous near base of ovary, with micropyle upwards. Fruit drupaceous, with albuminous seed. Flr. protogynous, anemophilous.
- Sparmannia** Linn. f. Tiliaceae. 3 sp. trop. and S. Afr. *S. africana* Linn. f. is often grown in hot-houses. Flrs. in cymose umbels (as is easily recognised by their centrifugal order of opening). The sta. are sensitive to contact, moving outwards when touched (cf. *Helianthemum*).

- Spartina** Schreb. Gramineae (XI). 7 sp. temp. in salt soil; 1 Brit. (*S. stricta* Roth, cord-grass).
- Spartium** Linn. Leguminosae (III. 3). 1 sp. Medit., *S. junceum* L., the Spanish broom, resembling the common broom in habit. Flrs. explosive like those of *Genista*. They yield a yellow dye, and the plant is also used as a source of fibre.
- Spathicarpa** Hook. Araceae (VII). 4 sp. Brazil and Paraguay. The spadix is adnate to the spathe, and monoecious. Down the centre run 1—3 rows of ♂ flrs., consisting each of a stalked synandrium, rather like a sporophyll of *Equisetum*; at the sides are the ♀ flrs., consisting each of a bottle-shaped ovary, surrounded by staminodes.
- Spathiflorae**. The 6th cohort of Monocotyledons (p. 135).
- Spathiphyllum** Schott. Araceae (II). 20 sp. trop. Am., 1 Phil. Is., Celebes. Spathe partly adnate to spadix. Flr. ♀, with perianth.
- Spathodea** Beauv. Bignoniaceae (II). 3 sp. trop. Afr. There are large water-pores on the backs of the leaflets near the midrib. In *S. campanulata* Beauv. the flr.-buds have an interesting protection-mechanism, the calyx being inflated and water secreted between it and the corolla (see Treub in *Ann. Buitenz.* VIII).
- Specularia** Heist. Campanulaceae (I. 1). 10 sp. Medit., Eur., N. Amer. *S. hybrida* A. DC. (*Campanula hybrida* L.) is a cornfield weed in England, and *S. Speculum* A. DC., Venus' looking-glass, is common in gardens. In general the flr. is like that of *Campanula*.
- Spergula** Linn. Caryophyllaceae (II. 2). 3 sp. temp. *S. arvensis* L., the spurry, occurs in most parts of the world on arable land. The axillary shoots do not lengthen their internodes, so that the leaves at first glance seem to be tufted. Flrs. in cymes, gynomonœcious or gynodioecious, homogamous, visited by insects, but self-fertilising in their absence. This plant is sometimes used as fodder.
- Spergularia** J. et C. Presl (*Buda* Adans., *Lepigonum* Wahlb., *Tissa* Adans.). Caryophyllaceae (II. 2). 20 sp. cosmop., mostly halophytes with fleshy leaves (p. 187). 1 in Brit.
- Spermacoe** Dill. ex Linn. (*Borreria* G. F. W. Mey.). Rubiaceae (II. 20). 80 sp. trop., esp. Am.
- Spermaphyta** or Phanerogamae. One of the 4 great divisions of the Vegetable Kingdom, comprising all those plants which produce seeds. The megaspore (embryo-sac) does not fall out of the sporangium (ovule), and the latter ripens, after fertilisation of the ovum, into a seed. In Cryptogamae the spore falls out of its sporangium and germinates upon the soil, so that a seed is not formed. The S. are divided into Gymnospermae and Angiospermae (q.v. and see Ch. II.).
- Sphaeralcea** A. St. Hil. Malvaceae (II). 21 sp. Cape Col., 4 Am.
- Sphaerolobium** Sm. Leguminosae (III. 2). 12 sp. Austr.
- Sphenotoma** Sweet = *Dracophyllum* Labill.
- Spigelia** Linn. Loganiaceae. 30 sp. Am. Some sp., e.g. *S. Anthelmia*

- L. and *S. marilandica* L. (Indian pink, or pink-root), have apparent whorls of 4 leaves close under the infl.; in reality the internode between the two pairs is very short. Infl. a cyme like that of Boraginaceae. The fruit is a capsule rather like that of Veronica and falls away leaving a sort of cupule. The style is jointed.
- Spilanthes** Jacq. Compositae (v). 30 sp. Am.
- Spinacia** (Tourn.) Linn. Chenopodiaceae (4). 2 sp. Orient. *S. oleracea* L. is the common spinach. Annual herbs with cymes of dioecious flrs., anemophilous. The bracteoles harden and surround the fruit as a membranous wing.
- Spinifex** Linn. Gramineae (v). 4 sp. Austr., Ceylon to Japan. Dioecious. The ♀ spikelets are 1-flowered with long spiny bracts, and are massed together into a head. This breaks off when the fruits are ripe, and blows about (cf. *Anastatica*), finally sticking in the sand and breaking up (Goebel, *Pflanzenbiol. Sch.* 1. p. 135).
- Spiraea** Linn. (excl. *Ulmaria* Tourn.). Rosaceae (I. 1). 40 sp. N. temp.; *S. Ulmaria* L. = *Ulmaria palustris*.
- Spiranthes** Rich. (incl. *Sarcoglottis* Presl, *Stenorhynchus* Rich.). Orchidaceae (4). 60 sp. N. temp. and trop.; 3 in Brit., incl. *S. autumnalis* Rich. (lady's tresses). *S. Romanzoffiana* Cham. et Schlecht., a native of N. Am. and Kamtschatka, occurs in meadows at Bantry Bay, Ireland, and has caused much discussion among geographical botanists. The infl. is twisted, so that the flrs. form a spiral. For mechanism of flr. see Darwin, *Orchids*, p. 106.
- Spondias** Linn. Anacardiaceae (II). 6 sp. trop. The 1—5-seeded drupe is edible (hog-plum).
- Sporobolus** R. Br. Gramineae (VIII). 80 sp. N. Am., Afr., As., S. Eur.
- Spraguea** Torr. Portulacaceae. 2 sp. West U.S.
- Sprekelia** Heist. Amaryllidaceae (I). 1 sp. Mexico, *S. formosissima* Herb., a greenhouse favourite.
- Sprengelia** Sm. Epacridaceae. 23 sp. Austr., Tasmania.
- Stachys** (Tourn.) Linn. Labiatae (VI. 4). 200 sp. cosmop., exc. Austr., N. Z.; 5 in Brit., incl. *S. Betonica* Benth. (wound-wort), *S. palustris* L. (marsh betony), &c. The tubers of *S. Sieboldi* Miq. are largely consumed in France &c. under the name of 'crosnes.'
- Stachytarpheta** Vahl. Verbenaceae (II). 45 sp. trop. and subtrop. (all but one Am.). The leaves of *S. dichotoma* Vahl (*S. jamaicensis* Gardn.) are sometimes used as tea.
- Stachyuraceae**. Dicotyledons (Archichl. Parietales). Only genus *Stachyurus*. See *Nat. Pfl.*
- Stachyurus** Sieb. et Zucc. Stachyuraceae. 2 sp. Japan, Himal.
- Stackhousia** Sm. Stackhousiaceae. 13 sp. Austr., N. Z.
- Stackhousiaceae**. Dicotyledons (Archichl. Sapindales). 2 gen. with 15 sp., Austr., N. Z. Herbs, more or less xerophytic with racemose or cymose infls. of ♀ flrs. K (5); C 5, perigynous; disc present;

A 5; G (2—5), 2—5-loc., with 1 erect anatropous ovule in each loc.; raphe ventral. Schizocarp. Seed with endosperm. *Genera*: Stackhousia, Macgregoria. Closely allied to Celastraceae. Placed in Celastrales by Benth.-Hooker.

**Stackhousieae** (Benth.-Hooker) = Stackhousiaceae.

**Stangeria** T. Moore. Cycadaceae. 1 sp. Port Natal, *S. paradoxa* T. Moore. See order.

**Stanhopea** Frost. Orchidaceae (19). 20 sp. trop. Am. Epiphytes with large pendulous flrs. The labellum is of a very complex shape (compare its near relative, *Coryanthes*), forming together with the column, a sort of cage. The mechanism of these flrs. is probably rather complex, and they require careful study in their native districts. In *S. tigrina* Batem., the handsomest of all, whose flrs. are 8 inches across, the labellum and column form a cage narrowing towards the mouth, and of a most extraordinary slipperiness, which leads to the supposition that fertilisation is effected by bees sliding down inside it. The base of the labellum is a bucket-like organ, covered with juicy hairs. Between it and the column are wide openings which enable insects to fly into the bucket. When they come out, finding the opening too narrow to spread their wings, they attempt to crawl out, and reaching the slippery surface where they can get no grip, slide down the cage and so out at the mouth. [For details see *Linn. Soc. Journ.* xxx. 1894, p. 286.]

**Stapella** Linn. Asclepiadaceae (11. 4). 80 sp. S. Afr.—the carrion-flower. The chief interest of these plants centres in the fleshy stems. Like the Cacti and the fleshy Euphorbias they inhabit arid regions, and exhibit similar swollen stems, the leaves reduced to thorns or scales, standing in 4 ranks corresponding to the usual leaf arrangement in the order. The green tissue occupies the periphery of the stem, and the centre is full of water storage cells (see p. 182, and compare other succulents). The flrs. are large, with a dull red colour and carrion smell, attracting flies to their aid in fertilisation. The corona is double.

**Staphylea** Linn. Staphyleaceae. 7 sp. N. temp. Often grown in shrubberies. The capsule is large and bladdery.

**Staphyleaceae**. Dicotyledons (Archichl. Sapindales). 6 gen. with 20 sp., chiefly N. Hemisph. Shrubs or trees with alt. or opp. leaves, usually unequally pinnate, stipulate. Flrs. in panicles, regular, 5-merous, with the axis forming a cupule and intra-staminal disc. K 5; C 5; A 5; G (3), 3-loc. with ∞ anatropous ovules, usually ascending, with ventral raphe. Capsule. Embryo straight, in rich endosperm. For details see *Nat. Pfl.* Chief genera: *Staphylea*, *Turpinia*. United to Sapindaceae by Benth.-Hooker, placed in Aesculinae by Warming.

**Statice** Tourn. ex Linn. (incl. *Goniolimon* Boiss.). Plumbaginaceae. 130 sp. cosmop., chiefly in steppes and salt marshes (p. 187). *S.*

*Limonium* L. (sea-lavender) and 2 others, on the coast of Brit. Infl. compound, mixed, the total infl. being a spike, the partial a drepanium. The flrs. of many sp., e.g. *S. Limonium*, are heterostyled like those of Primula.

**Stauntonia** DC. Lardizabalaceae. 2 sp. China, Japan.

**Staurostigma** Scheidw. Araceae (VII). 5 sp. Brazil.

**Steironema** Rafin. Primulaceae (III). 4 sp. N. Am.

**Stellis** Sw. Orchidaceae (12). 150 sp. trop. Am.

**Stellaria** Linn. (incl. *Malachium* Fries). Caryophyllaceae (II. 1). 80 sp. cosmop.; 7 in Brit. (chickweed, stitchwort). Of the Brit. sp., *S. media* Cyrill. has small homogamous flrs. that fertilise themselves in absence of insects; it flowers all the year round, and in winter (apparently on account of weak light, cold, &c.) the flrs. are often cleistogamic (p. 93). The number of sta. is most often 3, but varies a good deal (see Burkill, *Linn. Soc. Journ.* xxxi. 1895). The fls. of *S. graminea* L. are larger and protandrous, but with autogamy, whilst in *S. Holostea* L. the flrs. are still larger and very protandrous with but little self-fertilisation.

In *S. media* there is a double row of hairs on each internode. Water poured on the plant runs down these, and Stahl explains them as adaptations similar to drip-tips (cf. *Ficus*), for drying the plant after rain; Lindman thinks they convey the water to the leaf-axils, where it is absorbed by the plant.

**Stemonaceae**. Monocotyledons (Liliiflorae). 3 gen. with 8 sp., E. Ind., Am., Austr., &c. The chief genus is *Stemona* Lour. See *Nat. Pfl.*, and Lachner-Sandoval in *Bot. Centr.* 50, p. 65, 1892.

**Stenophragma** Celak. Cruciferae (IV. 15). 1 sp. Spain.

**Stenorhynchus** Rich. = *Spiranthes* Rich.

**Stenospermation** Schott. Araceae (II). 4 sp. trop. Am., sub-andine.

**Stenotaphrum** Trin. Gramineae (v). 4 sp. Polynes., Am. *S. americanum* Schrank is useful for binding drift-sand (cf. *Ammophila*).

**Stephanotis** Thou. Asclepiadaceae (II. 4). 15 sp. Madag., Malaya, Cuba. Largely cultivated for their scented flrs.

**Sterculia** Linn. Sterculiaceae. 90 sp. trop. Flrs. unisexual, apetalous.

**Sterculiaceae**. Dicotyledons (Archichl. Malvales). 48 gen. with 660 sp. chiefly trop. Trees, shrubs, or herbs, with alt. stip. leaves; some are lianes. Flrs. in complex cymes, ♂, usually regular, 5-merous. K (5), valvate, with no epicalyx; C often absent or small, convolute; A in 2 whorls, the outer stammodial or o, the inner often branched, all more or less united into a tube, anthers 2-loc.; G usually (5), with 2—∞ anatropous ovules in each, with the micropyle outwards; style simple, lobed. Fruit various, often a schizocarp. Endosperm. Cola and Theobroma (cacao) are economically important. Chief genera: *Dombeya*, *Hermannia*, *Melochia*, *Buettneria*, *Theobroma*, *Helicteres*, *Sterculia*, *Cola*. Placed in Malvales by Benth.-Hooker, in Columniferae by Warming.

- Stereospermum** Cham. Bignoniaceae (II). 12 sp. trop. Afr. As.
- Sternbergia** Waldst. et Kit. Amaryllidaceae (I). 12 sp. Medit.
- Stevia** Cav. Compositae (II). 100 sp. trop. and subtrop. Am.
- Stiffia** Mikan (*Augusta* Leandr.). Compositae (XII). 4 sp. Brazil Shrubs.
- Stillingia** Linn. Euphorbiaceae (A. II. 7). 15 sp. Am., Polynes. Mascarenes. [For *S. sebifera* Michx. see *Sapium*.]
- Stipa** Linn. Gramineae (VIII). 100 sp. trop. and temp., usually xerophytes. *S. pennata* L., the feather grass of the Steppes, and many others have leaves which roll inwards when the air is dry, covering up the stomata and green tissue (which are on the upper side only) and exposing only the woody lower surface to the atmosphere. The awn of the fruit is very long, ending in a long feather. It is hygroscopic, curling up when dry and uncurling when damp. The fruit is thin and sharply pointed, with backward-pointing hairs on the tip. As in *Erodium*, the awn when damped uncurls, and, if the point of the fruit be on the soil and the feather be entangled with other objects, drives the fruit into the soil. When the air dries the feather is drawn down, not the fruit upwards. *S. tenacissima* L. (N. Afr.) is the esparto grass, from which paper is extensively made.
- Stokesia** L'Hérit. Compositae (I). 1 sp. South-east U.S.
- Stratiotes** Linn. Hydrocharitaceae. 1 sp., *S. aloides* L. (water soldier), Eur. (incl. Brit.). It has a short stem bearing roots and a number of aloe-like leaves with toothed edges. In the summer it floats up to the surface and bears the (dioecious) flrs. It then sinks again, and once more comes up in August or later. Whilst down it gives off numerous axillary shoots with big buds at the ends, and when it floats again these grow into young plants, which soon become free and sink to the bottom, where they remain over the winter. [See p. 168.]
- Strelitzia** (Banks) Ait. Musaceae. 5 sp. Afr. *S. augusta* Thunb. and *S. Reginae* Banks are often grown in hothouses. Flrs. in a cincinnus in the axil of a large spathe. Sepals free; the lateral petals united, irregular, enclosing the 5 sta. Fertilised by birds (*Ber. D. Bot. Ges.* 1894, p. 53).
- Streptanthus** Nutt. Cruciferae (I. 1). 22 sp. Pacific N. Am.
- Streptocarpus** Lindl. Gesneriaceae (I). 30 sp. Afr. The life-history is peculiar. In *S. polyanthus* Hook. (see Hielscher, in Cohn's *Beitr. z. Biol. d. Pfl.*, vol. III) the embryo in the exalbuminous seed has 2 cotyledons and a hypocotyl, but no plumule or radicle; the hypocotyl enters the soil, swells up at the end and develops absorbent hairs; presently however roots (adventitious) form above the swelling, which dies off. In the meanwhile one of the cotyledons continues to grow, while the other dies. Thus the young plant presently consists of a large green cotyledon with few adventitious roots. The cotyledon continues to grow, and reaches a considerable size. Finally the infl. arises as a bud from the base of the petiole, and leafy shoots may also



arise. (Compare the artificial propagation of *Sinningia*.) Other sp. show somewhat similar phenomena.

**Streptocaulon** Wight et Arn. Asclepiadaceae (I. 1). 7 sp. E. Ind. to Philippine Is.

**Streptochaeta** Schrad. Gramineae (VI). 1 sp. Brazil. The awns lever out the fruits in a peculiar way (see F. Müller in *Kosmos*, 1885).

**Streptopus** Michx. Liliaceae (VII). 4 sp. N. temp.

**Streptosolen** Miers. Solanaceae (V). 1 sp. trop. S. Am.

**Strobilanthes** Blume (*Goldfussia* Nees). Acanthaceae (IV. A). 180 sp. trop. As., Madag. Some, e.g. *S. anisophyllus* T. Anders., show marked anisophylly (p. 38). The stigma is sensitive to contact (cf. *Mimulus*); when touched it moves downwards, and becomes pressed against the lower lip of the flr.

**Stromanthe** Sond. Marantaceae. 5 sp. trop. Am.

**Strophanthus** DC. Apocynaceae (II. 5). 28 sp. Cape Col. to China. The free parts of the petals are long and threadlike; the two follicles often stand in a straight line when ripe. The seeds of *S. hispidus* DC. (S. Afr.) furnish the drug strophanthin.

**Struthiola** Linn. Thymelaeaceae. 24 sp. Cape Col. and trop. Afr.

**Strychnos** Linn. Loganiaceae. 65 sp. trop. Some sp., e.g. *S. Nux-vomica* L., are erect trees, others are climbing shrubs, with curious hook-tendrils. The hook consists of a modified axillary shoot, and it is noteworthy that the leaf in whose axil it arises does not as a rule develop normally like the one opposite to it on the stem, but becomes a scale leaf. If the hook catch upon a support it twines close round it and thickens and lignifies (cf. *Clematis* and see p. 176). Other sp. have axillary thorns. A few sp. have a 1-loc. ovary with free-central placenta. The fruit is a berry; the flesh is harmless, but the seeds are exceedingly poisonous, owing to the presence of strychnine in the seed-coats. From these seeds the alkaloid is chiefly obtained. *S. toxifera* Schomb. (S. Am.) yields the famous Wourali or curare poison, with which the S. Am. Indians poison their arrows; it is obtained from the bark by scraping and maceration in water.

**Sturmia** Rchb. = *Liparis* Rich.

**Stylidiaceae** (Benth.-Hooker) = *Candolleaceae*.

**Stylidium** Sw. = *Candollea* Labill.

**Stylochiton** Lepr. Araceae (VII). 2 sp. Cent. Afr. The monoëcious infl. remains below the ground, only the tip protruding; the spathe opens at the top, and by this opening the pollinating agents enter.

**Stylophorum** Nutt. Papaveraceae (II). 1 sp. Atlantic N. Am.

**Stylosanthes** Sw. Leguminosae (III. 7). 25 sp. trop. and subtrop.

**Styphelia** Sm. (incl. *Cyathodes* Labill., excl. *Leucopogon* R. Br.). Epacridaceae. 30 sp. Austr., N. Z., New Caled., Sandwich Is.

**Styracaceae**. Dicotyledons (Sympet. Ebenales). 6 gen. with 73 sp. There are 3 centres of distribution—Brazil to Peru and Mexico, Virginia to Texas, Japan to Java. A single sp., *Styrax officinalis*,

is Mediterranean, and its presence there may perhaps be referred to Tertiary times, from whose strata various fossil *S.* have been obtained. Shrubs and trees with alt. simple leaves, usually entire and often leathery. Infl. usually racemose, with no bracteoles. Flr. ♂, regular. K (5—4); C (5—4), often nearly polypetalous; A twice as many as petals, in one whorl, united at base or into a tube, with narrow or linear, rarely round anthers; G (3—5), 3—5-loc. below, 1-loc. above, with 1 or few pendulous anatropous ovules in each loc.; style simple, stigma capitate or lobed. Fruit drupaceous, with fleshy or dry dehiscent pericarp, and one or few seeds. Embryo straight, in endosperm. *Chief genera*: *Halesia*, *Styrax*. For distinction between *S.* and *Symplocaceae*, see the latter order. The absence of latex distinguishes *S.* from *Sapotaceae*, the ♀ flrs. from *Ebenaceae*. Placed in *Ebenales* by Benth.-Hooker, in *Diospyrinae* by Warming.

**Styrax** (Tourn.) Linn. *Styracaceae*. 60 sp. with distribution of order. *S. officinale* L. yields storax, a resin much used in ancient times. *S. Benzoin* Dryand. (Sumatra, &c.) yields the fragrant resin gum-benzoin, obtained by cutting notches in the bark. It is used medicinally and for incense.

**Suaeda** Forsk. *Chenopodiaceae* (9). 40 sp. universal, on the sea-coast, and in salt steppes (p. 187). Herbs with fleshy leaves and dense cymes of flrs. *S. maritima* Dum., the sea-blite, is common on the Brit. coast, and *S. fruticosa* Forsk. is also found.

**Subularia** Ray ex Linn. *Cruciferae* (II. 5). 1 sp. Abyss. and 1 sp. in Eur. (incl. Brit.), As., N. Am., *S. aquatica* L., the awl-wort. It grows at the margin of lakes, usually submerged, and has long narrow leaves, nearly circular in section (p. 171.) The flrs. may project above the water and open, or may remain submerged, in which case they fertilise themselves in the bud. This plant is one of the few aquatic annuals.

**Succisa** Neck. = *Scabiosa* Tourn. *S. pratensis* Moench = *Scabiosa Succisa*.

**Succowia** Medic. *Cruciferae* (II. 9). 1 sp. W. Medit., Teneriffe.

**Swainsona** Salisb. *Leguminosae* (III. 6). 30 sp. Austr., N. Z., Siberia.

**Swartzia** Schreb. (*Toumatea* Aubl.). *Leguminosae* (II. 9). 60 sp. trop. Am., 1 trop. Afr.

**Swertia** Linn. *Gentianaceae* (I. 3). 70 sp. Eur., As., Afr., Am. *S. perennis* L. is often cultivated. The corolla-segments bear each 2 nectaries on the upper side, consisting of little pits covered with hairs.

**Swietenia** Jacq. *Meliaceae*. 3 sp. trop. Am., incl. *S. Mahogoni* Jacq., the mahogany, a valuable timber tree.

**Sympetalae** (Engler, Warming). The higher division of *Dicotyledons* (pp. 139, 146 and cf. 68).

**Symphoricarpos** Dill. ex Linn. *Caprifoliaceae* (III). 8 sp. N. Am. *S. racemosus* Michx. is the snowberry of shrubberies. The pendulous

flr. is fertilised chiefly by wasps (cf. *Scrophularia*). The honey, secreted at the base of the style, is protected from rain, and prevented from flowing out, by the hairs on the corolla. The anthers are towards the outer side of the hairy mass. The wasp, being short tongued (see p. 64), thrusts its whole head into the flr. and touches stigma and sta.; pollen adheres to it as it withdraws its head sticky with honey.

**Symphandra** A. DC. Campanulaceae (1. 7). 7 sp. E. Medit. Like *Campanula*. The pendulous capsule opens at the base (cf. *Campanula*).

**Symphytum** Tourn. ex Linn. Boraginaceae (IV. 3). 15 sp. Medit., Eur. *S. officinale* L. (comfrey) is common in Brit. and *S. tuberosum* L., with tubers like those of potato, also occurs. The pendulous flr. is bee-visited; the entrance to the honey is narrowed by the corolla-scales, whose margins are prickly. Mechanism of flr. as in *Borago*. Some sp. of *S.* are grown as fodder plants, e.g. *S. asperrimum* Donn.

**Symplocaceae**. Dicotyledons (Sympet. Ebenales). Only genus *Symplocos* (q.v.). The genus is placed in *Styracaceae* by Benth.-Hooker &c. The chief distinction is the inferior ovary of *Symplocos* and its complete division into loculi; the shape of the anthers is also different, and the sta. are often more numerous.

**Symplocarpus** Salisb. Araceae (III). 1 sp., *S. foetidus* Nutt., the skunk-cabbage, Japan, E. As., Atlantic N. Am.

**Symplocos** Jacq. The only genus of *Symplocaceae* (q.v.). 150 sp. trop. and subtrop. Shrubs and trees with alt. simple exstip. leathery leaves, and racemed bracteolate & regular flrs. K (5), imbricate; C (5) or (5+5), imbricate; A 5 or 5+5 or 5+5+5 or more, epipetalous or free of corolla; anthers round or ovate; G (2—5), inferior or semi-inferior, with 2—4 anatropous pendulous ovules on an axile placenta in each loc. Style simple, stigma capitate or lobed. Fruit drupaceous, one seed in each loc. of the stone. Embryo straight or curved, in endosperm.

**Synanthae**. The 5th cohort of Monocotyledons (p. 135).

**Synechanthus** H. Wendl. Palmae (IV. 6). 3 sp. trop. Am.

**Synedrella** Gaertn. Compositae (v). 2 sp. trop. Am.

**Syngonium** Schott. Araceae (VI). 10 sp. W. Ind., Brazil. Climbers with cymes of monoëcious spadices. Synandrous.

**Syringa** Linn. Oleaceae (1. 2). 10 sp. Eur., As. *S. vulgaris* L. is the common lilac, largely cultivated in Brit. (not native). It has well-marked false dichotomy; the terminal bud usually fails to develop each spring and the two nearest lateral buds continue the growth. The winter buds are scaly, and the scales secrete a gummy substance as the bud elongates. The flrs. are in panicles, each branch with a terminal flr. The seeds are flat and slightly winged.

**Syringa** Tourn. ex Adans. = *Philadelphus* Riv.

**Syzygium** Gaertn. = *Eugenia* Mich.

**Tabebuia** Gomez. Bigoniaceae (II). 6 sp. trop. Am.

**Tabernaemontana** Plum. ex Linn. Apocynaceae (I. 3). 110 sp. trop.

**Tacca** Forst. Taccaceae. 9 sp. trop. As., S. Am. There is a creeping tuberous rhizome bearing large branched leaves on long stalks, and cymose umbels of flrs. on scapes.  $P\ 3+3$ , regular;  $A\ 3+3$ ;  $\bar{G}\ (3)$ , 1-loc. with parietal placentae and  $\infty$  anatropous ovules. Style short, with 3 branches petaloid above, each 2-lobed with the stigmas on their under sides. Fruit a berry. East Indian arrowroot is made from the rhizomes of *T. pinnatifida* Forst. and other sp.

**Taccaceae**. Monocotyledons (Liliiflorae). 2 gen., *Tacca* (q.v.) and *Schizocapsa* (fruit a capsule). The order has been placed in many positions in the natural system by various writers (see *Nat. Pfl.*); Benth.-Hooker place it in Epigynae.

**Taccarum** Brongn. Araceae (VII). 3 sp. Brazil.

**Tacsonia** Juss. Passifloraceae. 25 sp. trop. Am. United to *Passiflora* in *Nat. Pfl.*

**Tagetes** Linn. Compositae (VI). 20 sp. Arizona to Argentina. *T. signata* Bartl. is a favourite border plant.

**Talauma** Juss. Magnoliaceae (I). 8 sp. trop. E. As. and 4 sp. trop. Am. Like *Magnolia*, but fruit indehiscent or breaking off from a persistent base.

**Talinum** Adans. Portulacaceae. 15 sp. Afr., Am.

**Tallisia** Aubl. Sapindaceae (I). 33 sp. S. Am.

**Tamaricaceae**. Dicotyledons (Archichl. Parietales). 5 gen. with 90 sp temp. and subtemp. Desert, shore, and steppe plants (p. 187 &c.). Shrubs or herbs with alt. exstip. leaves, often heath-like. Flrs. solitary or in racemose infls., ebracteolate,  $\bar{g}$ , regular, hypogynous.  $K\ 4-5$ ;  $C\ 4-5$  (except *Fouquieria*);  $A\ 4-5$ , 8-10 or  $\infty$ , on a disc;  $\bar{G}\ (4-5\text{ or }2)$ , 1-loc. Styles usually free. Ovules  $\infty$  or few, on basal-parietal placenta, ascending, anatropous. Capsule. Seeds hairy. Embryo straight; endosperm or not. *Chief genera*: *Reaumuria*, *Tamarix*, *Myricaria*, *Fouquieria*. Placed in Caryophyllinae by Benth.-Hooker, in Cistiflorae by Warming.

**Tamarindus** Tourn. ex Linn. Leguminosae (II. 3). 1 sp. trop. Afr., *T. indica* L., the tamarind, largely cultivated in the tropics for its valuable fruit (the part eaten is the pulp round the seeds; it is also officinal). The 2 anterior petals are reduced to bristles, and the 3 fertile sta. united below to form a tube. The wood is useful, not being attacked by insects.

**Tamariscineae** (Benth.-Hooker) = Tamaricaceae.

**Tamarix** Linn. Tamaricaceae. 64 sp. Eur., As., Medit. *T. gallica* L. (tamarisk) is a doubtful native on the S. and E. coasts of England. *T. mannifera* Ehrenb. (Egypt to Afghanistan) produces, owing to the punctures of the insect *Coccus manniparus*, the manna of the Bedouins, a white substance which falls from the twigs.

- Tambourissa** Sonner. Monimiaceae. 14 sp. Java, Mascarenes.
- Tamonea** Aubl. Melastomaceae (I). 550 sp. trop. Am.
- Tamus** Linn. Dioscoreaceae. 2 sp. Eur., Medit. *T. communis* L. (black bryony) in Brit. Climbing plants, hibernating by tubers formed by a lateral outgrowth of the first two internodes of the stem.
- Tanacetum** Tourn. ex Linn. Compositae (VII). 50 sp. N. Hemisph. *T. vulgare* L. (tansy) is often cultivated as a popular remedy in colds &c. Included in *Chrysanthemum* in *Nat. Pf.*
- Taonabo** Aubl. = *Ternstroemia* Mutis.
- Taraxacum** Linn. Compositae (XIII). 25 sp. temp. *T. officinale* Weber (dandelion) is almost cosmop. The thick primary root is perennial and is crowned by a very short sympodial stem; each year a new bud is formed on the leafy axis, to come into active growth in the following year. The roots as they grow to maturity contract and thus drag the stem downwards so that it never rises much above the soil. If the root be cut through, a callus forms over the wound, and from this adventitious shoots develop. The floral mechanism &c. are of the usual type of the order, and show the final autogamy very clearly.
- Tarchenanthus** Linn. Compositae (IV). 3 sp. S. Afr.
- Taxaceae.** An order of Coniferae (q.v.).
- Taxodium** Rich. (excl. *Glyptostrobus* Endl.). Coniferae (Arauc. 1 c; see C. for genus characters). 2 sp. N. Am. (swamp-cypresses), *T. distichum* Rich. and *T. mexicanum* Carr. In the former, and especially in swampy ground, curious 'knees' are formed, which are hollow spherical branches projecting upwards from the roots; they are supposed to be aerating organs (cf. *Sonneratia*).
- Taxus** (Tourn.) Linn. Coniferae (Taxaceae, 4; see C. for genus characters). About 8 sp. N. temp., of which *T. baccata* L., the yew, is best known. There are no short shoots, but the leaves of the spreading branches arrange themselves more or less closely in two rows with their upper surfaces nearly in one plane, giving a dorsiventral structure to the shoot. The fls. are dioecious, solitary in the axils of the leaves of the preceding year. The ♂ has a few scale-leaves below and about 8 or 10 sta., each of which is shield-shaped with a number of pollen-sacs on the axial side of the shield arranged round its stalk like the sporangia in *Equisetum*. The ♀ has a rather complex structure. The primary axis bears scale-leaves only. In the axil of one of the uppermost of these arises a shoot, continuing the line of the first axis and bearing 3 pairs of scales and a terminal ovule. This is orthotropous with one integument, and develops into a seed surrounded by a cup-shaped red and fleshy aril.
- The wood of the yew is valuable; in the middle ages it was the chief material used in making bows. The leaves are very poisonous, but the aril is harmless. Birds swallow it, and thus distribute the seeds.

- Tecoma** Juss. (incl. *Tecomaria* Spach, *Campsis* Lour., *Campsidium* Seem., *Pandorea* Endl., and other genera retained by Schumann in *Nat. Pfl.*). 90 sp. trop. and warm temp. *T. radicans* Juss., which climbs like ivy, is often grown in gardens.
- Tectona** Linn. f. Verbenaceae (IV). 3 sp. Indo-mal. *T. grandis* L. f. is the teak-tree, largely cultivated in Java, India, &c., for its timber, which is very hard and durable; enormous quantities of it are used for ship-building, &c. The wood sinks in water unless thoroughly dried; this is effected in India by the process of 'girdling,' which consists in removing a ring of bark and sap-wood from the tree near the base. It of course soon dies, and is then left standing for two years.
- Teesdalia** R. Br. Cruciferae (II. 5). 2 sp. Eur., Medit.; 1 in Brit. The flrs. are arranged in a corymb, which gradually draws out into a raceme as flowering progresses.
- Telfairia** Hook. Cucurbitaceae (II). 2 sp. trop. Afr., Mascarenes. *T. pedata* Hook. is cultivated for its seeds, which are edible and also yield oil.
- Tellima** R. Br. Saxifragaceae (I). 7 sp. N.W. Am.
- Templetonia** R. Br. Leguminosae (III. 3). 7 sp. Austr. Like *Bossiaea*.
- Tephrosia** Pers. Leguminosae (III. 6). 120 sp. trop. and subtrop., esp. Afr., Austr.
- Terminalia** Linn. Combretaceae. 105 sp. trop. The fruits of many sp. are winged (see order). Those of *T. Chebula* Retz. and others (myrobalans) are used in dyeing and tanning, and also in medicine.
- Ternstroemia** Mutis ex Linn. (*Taonabo* Aubl.). Theaceae. 20 sp. S. Am., 8 As.
- Ternstroemiaceae**. An order in Bentham and Hooker's 5th cohort (Guttiferales) divided into several orders in Engler's system. The bulk of the genera are placed in *Theaceae*, the rest in *Caryocaraceae*, *Marcgraviaceae*, *Stachyuraceae*, *Dilleniaceae*, &c.
- Testudinaria** Salisb. Dioscoreaceae. 2 sp. Cape Col. *T. Elephantipes* Salisb. (Hottentot bread) is common in hothouses. It has the general habit of a *Dioscorea*, but has an enormous tuber projecting out of the soil, with a thick outer coating of cork. This tuber is the swollen first internode of the stem. From it yearly, during the wet season, there springs by adventitious budding the year's shoot, a long thin climbing stem with large leaves and small flrs. This dies down in the dry season, and the corky covering protects the mass of the plant from drought (p. 182).
- Tetracera** Linn. Dilleniaceae. 45 sp. trop., esp. Am.
- Tetragonia** Linn. Aizoaceae (II. 3). 50 sp. Cape Col., Austr., N.Z., &c. Sometimes 2 flrs. stand one above the other in the same axil. From the fruit thorny projections grow out which may bear flrs. (a proof of the axial nature of the inferior ovary). *T. expansa* Murr. is often used as a vegetable (New Zealand spinach).

**Tetragonolobus** Scop. = *Lotus* Tourn.

**Tetramicra** Lindl. (*Leptotes* Lindl.). Orchidaceae (13). 1 sp. Brazil.

**Tetranthera** Jacq. = *Litsea* Lam.

**Tetrapanax** C. Koch = *Fatsia* Dcne.

**Tetrapleura** Benth. Leguminosae (1. 4). 3 sp. trop. W. Afr.

**Tetrapteris** Cav. Malpighiaceae. 60 sp. trop. Am., W. Ind. Lianes.

**Teucrium** (Tourn.) Linn. Labiatae (1. 1). 100 sp. cosmop.; 4 in Brit. (wood sage or germander), incl. *T. scorodonia* L. Flr. with small upper lip, protandrous with movement of style and sta.

**Thalia** Linn. Marantaceae. 7 sp. trop. and sub-trop. Am. The staminode  $\beta$  (see order) is present.

**Thalictrum** Tourn. ex Linn. Ranunculaceae (3). 76 sp. N. Temp. (*T. flavum* L., the meadow-rue, and 2 others in Brit.). The flrs. are small; the perianth sepaloid or only slightly coloured and soon dropping off. Some sp. are visited by pollen-seeking insects, but *T. minus* L. and others have become wind-fertilised and protogynous, retaining however traces of their entomophilous ancestry in a slight cohesiveness of the pollen and the fact that as in the rest of the order the anthers dehisce successively (p. 84).

**Thapsia** Linn. Umbelliferae (9). 4 sp. Medit.

**Thea** Linn. (excl. *Camellia* Linn.). Theaceae. 8 sp. India to Japan. Often united to *Camellia*; *T.* has stalked nodding flrs., *C.* sessile upright ones. The chief sp. is *T. sinensis* L., the tea plant, largely cultivated in China, India, Ceylon, &c. When growing wild it forms a tree, but in cultivation it is kept pruned into a small bush. The young shoots are nipped off at certain stages (according to the kind of tea desired) and undergo various subsequent treatments (see Tschirch, *Indische Heil und Nutzpflanzen*). [Synonymy: *T. Bohea* L. and *T. viridis* L. = *T. sinensis*; *T. Camellia* Hoffmgg. = *Camellia japonica*.]

**Theaceae**. Dicotyledons (Archichl. Parietales). 16 gen. with 175 sp. trop. and subtrop. Trees or shrubs with simple alt. leathery leaves. Flrs. usually solitary,  $\gamma$ , often partly spiral. *K* 5, 6 or 7, imbricate, persistent; *C* 5, rarely 4, 9 or  $\infty$ , imbricate; *A*  $\infty$ , rarely 5, 10 or 15, free or in bundles or united into a tube; ovary superior, 2-3-5-10-loc., with 2, 4 or  $\infty$  anatropous ovules in each loc. Capsule or drupe. Embryo usually curved; endosperm little or none. The only important economic plant is *Thea*; *Camellia* is a favourite in green-houses. Chief genera: *Thea*, *Camellia*, *Gordonia*, *Ternstroemia*, *Eurya*. Benth.-Hooker unite to *T.* several other genera to form the order *Ternstroemiaceae* (q.v.). Warming places *T.* in *Cistiflorae*.

**Thelygonaceae**. See *Cynocrambaceae*.

**Thelygonum** Linn. (*Cynocrambe* Tourn.). *Cynocrambaceae* (only genus). 2 sp. Medit., Orient., incl. *T. Cynocrambe* L. (*C. prostrata* Gaertn.). The lower part has opp. leaves, the upper is sympodial with alt. leaves. Opposite each leaf in this part is a group of  $\delta$  flrs. without bracts, while in the axil of the leaf is a branch ending in  $\gamma$  flrs. The

theoretical explanation (see Eichler's *Blüthendiag.*) is that each limb of the sympodium ends blindly, bearing 2 leaves, only one of which develops. In the axil of the other stands the  $\sigma$  infl., while in the axil of the developed leaf arises the 'continuation' shoot of the sympodium, and below this, as an accessory bud, the shoot bearing the  $\varphi$  flr. P 2—5, A 10—30; in the  $\varphi$  an inferior ovary of 1 cpl. with basal style; ovule campylotropous. Fruit a drupe. The plant is used as spinach, but has an aperient action.

**Thelymitra** Forst. Orchidaceae (4). 20 sp. Austr. The flr. is almost regular. Some sp. fertilise themselves in the bud, the flr. however afterwards expanding.

**Thelypodium** Endl. Cruciferae (1. 1). 15 sp. U. S.

**Theobroma** Linn. Sterculiaceae. 12 sp. trop. Am., of which *T. Cacao* L. is the most important. Its flrs. are borne on the old wood, and give large tough berry-fruits, containing exalbuminous seeds, which after roasting &c., yield cocoa or chocolate. The young leaves are red and pendulous (p. 199).

**Theodora** Medic. = *Schotia* Jacq.

**Theophrasta** Linn. Myrsinaceae (1). 4 sp. W. Ind. The upper part of the stem bears thorny scales. Serial buds occur in the leaf-axils and ultimately cause the phenomenon of stem-flowering (p. 200), for flrs. arise in the axils of scale-leaves on these compressed shoots.

**Thermopsis** R. Br. Leguminosae (III. 2). 15 sp. Himal. to Carolina.

**Thesium** Linn. Santalaceae. 115 sp. chiefly N. temp. Old World. *T. humifusum* DC. in Brit. (bastard toad-flax). Herbaceous root-parasites with green leaves (see Scrophulariaceae, and p. 194). Flrs.  $\varphi$ , in racemes. The bract is adnate to the peduncle, and with the 2 bracteoles forms a sort of involucre. P (3—5), tubular. Ovary inferior.

**Thespesia** Soland. Malvaceae (IV). 4 sp. trop. As., Polynes.

**Thevetia** Linn. Apocynaceae (1. 3). 8 sp. trop. Am.

**Thibaudia** Ruiz et Pav. (excl. *Ceratostema* Juss.). Ericaceae (III. 8). 30 sp. trop. Am., often cultivated for their flrs.

**Thinouia** Planch. et Triana = *Thouinia* Poit.

**Thismia** Griff. Burmanniaceae. 6 sp. Indo-mal. Saprophytes. See Groom in *Ann. of Bot.*, June 1895.

**Thladiantha** Bunge. Cucurbitaceae (1). 8 sp. E. As. to Java. Climbing herbs with root-tubers.

**Thlaspi** (Tourn.) Linn. Cruciferae (II. 6). 60 sp. Medit., As., N. Am.; 3 in Brit. (penny-cress).

**Thouinia** Poit. (incl. *Thinouia* Planch. et Triana). Sapindaceae (1). 25 sp. trop. Am., W. Ind. Lianes.

**Thrinax** Linn. f. Palmae (1. 2). 10 sp. W. Ind. (thatch-palm). The leaves are used for roofing, and the plants also yield useful fibre.

**Thrinchia** Roth = *Leontodon* Linn.

**Thuja** Linn. (*Thuya* Linn.). Coniferae (Arauc. 2 b; see C. for genus



characters). 4 sp. China, Japan, N. Am., *T. occidentalis* L. is the American, *T. orientalis* L. the Chinese Arbor-vitae. The leaves are small and closely appressed to the stems, which show dorsi-ventral symmetry. Cones of 3 or 4 pairs of scales, the uppermost sterile and often united to form the *columella*, the lowest also often sterile.

[Synonymy: *T. dolabrata* Thunb. = *Thujopsis dolabrata*; *T. chilensis* Don = *Libocedrus chilensis*; *T. Doniana* Hook. = *L. Doniana*; *T. tetragona* Hook. = *L. tetragona*; *T. gigantea* Carr. = *Libocedrus decurrens*.]

**Thujopsis** Sieb. et Zucc. Coniferae (Arauc. 2 b; see C. for genus characters). 1 sp. Japan, *T. dolabrata* Sieb. et Zucc.

**Thunbergia** Retz. (incl. *Mayenia* Nees). Acanthaceae (III). 72 sp. trop. Old World. Many are hothouse favourites. A large number are twiners. The bracteoles enclose the calyx and tube of the flr. and are often united posteriorly.

**Thuya** Linn. = *Thuja* Linn.

**Thymelaea** Tourn. ex Scop. Thymelaeaceae. 20 sp. Medit., W. As.

**Thymelaeaceae**. Dicotyledons (Archichl. Thymelaeales). 38 gen. with 550 sp., temp. and trop., esp. in Afr. Most are shrubs with entire alt. stip. leaves and racemose infis. Flr. usually ♂, regular 4—5-merous. The receptacle is much hollowed, usually forming a deep tube of leafy consistence ('calyx-tube'); outgrowths of the axis are sometimes found at the base of the tube round the ovary. K petaloid, like the tube, usually imbricate; C conspicuous or small or 0; A as many or twice or half as many as sepals, inserted on the edge of the tube; ovary 1- or rarely 2-loc., each loc. with 1 pendulous anatropous ovule with ventral raphe; style simple. Fruit an achene, berry, or drupe, often enclosed in the persistent receptacle; a few genera have capsules. Embryo straight; endosperm little or none.

*Chief genera*: Gnidia, Thymelaea, Daphne, Pimelea. The family is a very natural one, but with no very close affinities. Many authors, e.g. Benth.-Hooker, place it near Santalaceae, but it is not a typically apetalous family, and seems nearer to Myrtiflorae or Parietales (see *Nat. Pfl.*). Warming places it in Thymelaeinae.

**Thymelaeales**. The 21st cohort of Archichlamydeae (p. 139).

**Thymelaeinae** (Warming). The 17th cohort of Choripetalae (p. 146).

**Thymus** Tourn. ex Linn. Labiatae (VI. 11). 80 sp. Medit., Abyss., Eur. *T. Serpyllum* L. (thyme) in Brit. The flrs. are gynodioecious (p. 89) with marked protandry. *T. vulgaris* L., the garden thyme, is used in flavouring.

**Thyracanthus** Nees. Acanthaceae (IV. B). 20 sp. trop. Am.

**Thyrsopteris** Kze. Polypodiaceae. 1 sp. Juan Fernandez.

**Thysanocarpus** Hook. Cruciferae (IV. 14). 6 sp. Calif.

**Thysanotus** R. Br. Liliaceae (III). 22 sp. Austr., S.E. As.

**Tiarella** Linn. Saxifragaceae (I). 4 sp. N. temp.

**Tibouchina** Aubl. Melastomaceae (I). 190 sp. trop. Am.

**Tigridia** Juss. Iridaceae (11). 7 sp. Mexico, Cent. Am. *T. Pavonia* Ker-Gawl. (tiger-flower) is common in gardens. The flrs. only last 8—12 hours.

**Tilia** (Tourn.) Linn. Tiliaceae. 10 sp. N. Temp. *T. platyphyllos* Scop. and other sp. of lime are found, native or planted, in Brit. Note the leaf-mosaic (see order). The flrs. are arranged in little cymes, arising from the axils of the leaves of the current year; the axillary growing point elongates transversely, giving rise to two buds, one of which forms the infl., the other the bud for the next year's growth. The further development of the infl. is too complex for description without figures, but throughout it there occurs 'adnation' of bracts to the axes arising in their axils, a peculiarity particularly noticeable in the first leaf of the infl.-axis, which forms a wing, covering the flrs. from rain and serving to distribute the fruits. [For details see *Nat. Pfl.*] Honey is secreted at the base of the sepals. The flrs. are protandrous and dependent upon insects for their fertilisation; they are largely visited by bees &c., and form a valuable source of honey. The fruit is a nut. The endosperm is very oily, and it has recently been proposed to utilise it commercially. The wood of lime and of *T. americana* L. (bass-wood) is useful. The leaves are usually covered with honey-dew (see *Acer*).

**Tiliaceae.** Dicotyledons (Archichl. Malvales). 35 gen. with 380 sp. trop. and temp., chiefly in S.E. As. and Brazil. Trees or shrubs, rarely herbs, with alt. stip. leaves, often showing a well-marked 2-ranked arrangement. In the trees the shoots spread out horizontally and the insertions of the leaves are upon the upper half, so that the divergence is not  $\frac{1}{2}$ . The end bud of the branch does not develop in the next year. Frequently the leaf is asymmetrical, with the smaller side towards the branch. In the herbaceous forms the leaves are in two ranks diverging at a right angle; torsion of the leaves occurs later on and produces a dorsiventrality. [See pp. 37, 38.] The infl. is always, at least after the first branching, cymose, and often very complex, e.g. in *Tilia* and *Triumfetta* (q.v.).

Flr. usually ♀, regular, 5—4-merous. K 5 or (5), valvate; C 5, rarely 0, often glandular at base; A usually ∞, free or united in groups, inserted at base of petals or on androphore, with ditheous anthers;  $\bar{G}$  (2—∞), 2—∞-loc., with 1—∞ ovules in each loc.; ovules usually ascending, ± anatropous; style simple, with capitate or lobed stigma. Seeds albuminous. The T. yield useful timber, jute (*Corchorus*) and other fibre. *Chief genera:* *Corchorus*, *Sparmannia*, *Tilia*, *Grewia*, *Triumfetta*. Benth.-Hooker unite *Elaeocarpaceae* to T. and place the order in Malvales; Warming places it in *Columniferae*. The most constant distinction from Malvaceae is in the ditheous anthers, from Theaceae in the valvate calyx, &c.

**Tillaea** Mich. ex Linn. Crassulaceae. 26 sp. temp. and trop. (1 Brit.). United to *Crassula* in *Nat. Pfl.*

**Tillandsia** Linn. (incl. *Vriesea* Lindl.). Bromeliaceae (4). 160 sp. trop. Am. Some resemble the rest of the order—epiphytes with pitchers—while others, and especially *T. usneoides* L. (long moss, old man's beard, vegetable horsehair), show a different habit. This plant hangs in long grey festoons from the branches of trees, looking rather like a lichen (especially *Usnea*). At the base, each of the pendent stems is wound round its support, and as the apex grows on downwards the older parts die away, leaving nothing but the axil strand of sclerenchyma (the 'horsehair'). The whole plant is thickly covered with the usual scaly hairs for absorbing the water trickling over it. It has no storage reservoir for water at all. The flrs. when they appear, which is but rarely, are of the usual type. The plant is largely distributed from tree to tree by the wind, small bits breaking off and blowing about. Birds also use it for nesting and thus carry it about. [See p. 184 and Schimper *Die epiph. Vegetat. Amerikas*, p. 67 and Plate II.] It is used like horsehair.

**Tinantia** Schiedw. Commelinaceae. 3 sp. trop. Am.

**Tinospora** Miers. Menispermaceae. 14 sp. trop. Old World.

**Tiassa** Adans. = *Spergularia* J. et C. Presl.

**Tithonia** Desf. ex Juss. Compositae (1). 10 sp. Cent. Am., W. Ind.

**Tithymalus** Tourn. ex Hall. = *Euphorbia* Linn.

**Tmesipteris** Bernh. Psilotaceae. 1 sp., *T. tannensis* Bernh., Austr., N. Z., Polynes. (rare). It grows as an epiphyte (?parasite) on the trunks of tree ferns. The rhizome bears large lanceolate green leaves.

**Tococa** Aubl. Melastomaceae (1). 40 sp. trop. S. Am.

**Toddalia** Juss. Rutaceae (1X). 8 sp. trop. As. Afr.

**Todea** Willd. Osmundaceae. 4 sp. S. Hemisph. *T. africana* Willd. (*T. barbara* Moore), is apogamous (see Filicineae Leptosporangiateae).

**Tofieldia** Huds. Liliaceae (1). 15 sp. N. temp. *T. palustris* Huds. (Scottish asphodel) in Brit. Like *Narthecium*. The flr. has a 3-lobed involucre (*calyculus*) beneath the calyx.

**Tolmiea** Torr. et Gray. Saxifragaceae (1). 1 sp., *T. Menziesii* Torr. et Gray, N.W. Am. Adventitious buds are formed on the upper part of the petiole. The axial cup is split down the anterior side. Petals thread-like; only the 3 posterior sta. occur.

**Toluifera** Linn. (*Myroxylon* Forst.). Leguminosae (III. 1). 6 sp. trop. S. Am. *T. Pereirae* Baill. yields Balsam of Peru, and *T. punctata* Baill. Balsam of Tolu, from incisions in the bark; these substances are medicinal.

**Tordylium** Tourn. ex Linn. Umbelliferae (7). 12 sp. Eur. (1 Brit.), N. Afr., As.

**Torenia** Linn. Scrophulariaceae (II. 8). 20 sp. trop. As., Afr., Am.

**Torilis** Adans. = *Caucalis* Linn.

**Tormentilla** (Tourn.) Linn. = *Potentilla* Linn.

**Tornelia** Gutierrez = *Monstera* Adans.

**Torreya** Arn. Coniferae (Taxaceae 4; see C. for genus characters). 4 sp. N. Am., China, Japan. Like *Taxus*. The timber is useful.

**Tounatea** Aubl. = *Swartzia* Schreb.

**Tournefortia** Linn. Boraginaceae (III). 120 sp. trop. Trees and shrubs.

**Tovaria** Ruiz et Pav. Tovariaceae. 1 sp. W. Ind., S. Am.

**Tovariaceae**. Dicotyledons (Archichl. Rhœadales). Only genus *Tovaria*. United to Cappariaceae by Benth.-Hooker. See *Nat. Pf.*

**Tovomita** Aubl. Guttiferae (V). 30 sp. trop. Am.

**Townsendia** Hook. Compositae (III). 17 sp. Rocky Mts.

**Toxicodendrum** Thunb. Euphorbiaceae (A 1. 1). 1 sp. Cape Colony. The fruit is used for poisoning hyænas.

**Toxicophlaea** Harv. = *Acokanthera* G. Don.

**Tozzia** Linn. Scrophulariaceae (III 12). 1 sp. Alps, 1 Carpathians (p. 159). Semi-parasites, with loose-pollen flrs. (see order).

**Trachelium** Tourn. ex Linn. Campanulaceae (I. 1). 7 sp. Medit.

**Trachelospermum** Lem. Apocynaceae (II. 4). 6 sp. E. As.

**Trachylobium** Hayne. Leguminosae (II 3). 3 sp. trop. As., E. Afr. These trees yield copal, which is dug up from the soil near their roots or in a half fossilised condition from places where trees formerly existed.

**Trachymene** Rudge. Umbelliferae (I) 14 sp. Austr. to Borneo.

**Tradescantia** Rupp. ex Linn. Commelinaceae. 30 sp. trop. and N. Am. *T. virginiana* L. (spider wort) and others are garden favourites. There are 6 perfect sta. covered with hairs. Flr. protandrous.

**Tragia** Plum. ex Linn. Euphorbiaceae (A. II. 2). 50 sp. trop.

**Tragaceros** H. B. et K. Compositae (V) 4 sp. Mexico. The corolla of the ♀ flr. becomes rigid after fertilisation has occurred, and forms a double hook upon the fruit.

**Tragopogon** (Tourn.) Linn. Compositae (13). 35 sp. Old World, N. temp. (*T. pratensis* L., the goat's beard, in Brit.). The flower-heads of the Brit. sp. close up at midday, whence its common name of 'John-go-to-bed-at-noon.' *T. porrifolius* L. is the salsify, sometimes grown as a vegetable.

**Trapa** Linn. Hydrocaryaceae. 3 sp. Old World (horn-nut), incl. *T. natans* L. and *T. bispinosa* Roxb. Water plants with submerged and floating leaves of different form (p. 173). Flr. ♀, 4-merous, perigynous, with a disc. above the sta. Ovary 2-loc., with one anatropous pendulous ovule in each loc.; raphe ventral. Seed large, exalbuminous, in a hoined nut. The seeds are used as food in China, &c. For their remarkable germination see Goebel's or Schenk's works, quoted on p. 204.

**Tremandra** R. Br. Tremandraceae. 2 sp. Austr.

**Tremandraceae**. Dicotyledons (Archichl. Geraniales). 2 gen. with 26 sp. Austr. (p. 203). Herbs with whorled, alt. or opp., exstip. leaves.

**Fls.** dichlamydeous, regular. K 4—5, rarely (4—5), valvate; C 4—5, valvate; A 8, 10, or rarely 6; G (2), medianly placed; style and stigma simple; ovules 1 or 2 in each loc., anatropous. Capsule, loculicidal or also septicidal. Albuminous seed, with or without aril.

**Genera** Tetratheca, Tremandra. Placed in Polygalinae by Benth.-Hooker, in Aesculinae by Warming.

**Tremandreae** (Benth.-Hooker) = Tremandraceae.

**Trentepohlia** Roth = Heliophila Burm. f.

**Trianea** Karst. = Limnobiium Rich.

**Tribulus** Tourn. ex Linn. Zygophyllaceae. 12 sp. Afr., As., Am., Medit (caltrops). The mericarps are provided with sharp rigid spines which stick into the foot of any animal treading on the fruit, or may catch in its fur, thus getting distributed. Each mericarp contains 3—5 seeds, and is divided by cross walls which develope after fertilisation.

**Trichulia** P. Br. Meliaceae 150 sp. trop.

**Trichocline** Cass. Compositae (XII). 28 sp. S. Am.

**Tricholaena** Schrad. Gramineae (v). 10 sp. Afr.. *T. rosea* Nees is cultivated for bouquets

**Tricholepis** DC. Compositae (XI). 12 sp. Asia.

**Trichomanes** Sm Hymenophyllaceae. 100 sp. with the distribution of the order; *T. radicans* Sw, the bristle fern, in Ireland.

**Trichonema** Ker-Gawl = Romulea Maratti.

**Trichopilia** Lindl. Orchidaceae (28). 18 sp. trop Am.

**Trichosanthes** Linn. Cucurbitaceae (III). 42 sp. E. Ind. to Austr

**Trichosma** Lindl. Orchidaceae (5). 1 sp. Himal. The axis is lengthened at the top and carries the lateral sepals forward, forming a chin.

**Trichosporum** D. Don = Aeschynanthus Jack

**Tricyrtis** Wall. Liliaceae (i). 5 sp. Himal., E. Asia

**Tridax** Linn. Compositae (v). 15 sp. trop. Am

**Trientalis** Rupp ex Linn. Primulaceae (III) 2 sp. N. temp. *T. europaea* L. (chickweed winter-green) sub-alpine in Brit. There is a rhizome with erect stem bearing about 4—7 leaves in a tuft and a few 7-merous flrs

**Trifolium** (Tourn.) Linn. Leguminosae (III. 4). 250 sp. temp. and subtrop.; 20 in Brit. (clover, trefoil, shamrock). The flr. has the simplest of the various mechanisms found in the order, the sta. and style emerging as the keel is depressed by an insect resting on the wings, and returning into it when it is released. The flrs. of white clover are an important source of honey; those of red clover are too long-tubed for hive-bees and are visited by humble-bees. *T. subterraneum* L. has two kinds of infl., one normal, the other becoming subterranean. Only 3 or 4 of its flrs. develope, the rest forming grappels (each sepal forming a reflexed hook); the stalk of the infl. bends downwards and gradually forces the flrs. under the earth,

where the fruits ripen (cf. *Arachis*). *T. badium* Schreb. has a wing upon the fruit formed by the persistent corolla, *T. fragiferum* L. a bladderly 'wing' formed by the calyx. The clovers are important pasture and hay plants; among the chief sp. are *T. repens* L. (white or Dutch clover), *T. pratense* L. (red clover), *T. hybridum* L. (alsike), &c.

**Triglochin** Riv. ex Linn. Juncaginaceae. 12 sp. cosmop.; 2 in Brit. (arrow-grass), in fresh water- or salt-marshes (*T. palustre* L. and *T. maritimum* L.). Tufted herbs with leafless flowering stems (*scapes*) ending in spikes or racemes. Leaves linear, fleshy in the maritime sp. (p. 187). P 3+3, A 3+3, G (3+3), or sometimes 3 with 3 abortive cpls. between the fertile. By a process of secondary growth the inner whorl of perianth comes to stand higher on the axis than the outer sta. Fl. protogynous, wind-pollinated. The pollen collects in the hollowed bases of the perianth-leaves. The ripened cpls. surround a central beak (cf. *Geranium*), and are prolonged outwards at the base into long sharp spines, by whose means, breaking away from the beak, they are animal-distributed.

**Trigonella** Linn. Leguminosae (III. 4). 70 sp. Medit., Eur. (1 Brit.), As., S. Afr., Austr. *T. Foenum-graecum* L. (fenugreek) is sometimes cultivated; its seeds are used in veterinary medicine. The flrs. of *T. Aschersoniana* Urban bury themselves like those of *Arachis*.

**Trigonella** Aubl. Trigonaceae. 26 sp. trop. Am.

**Trigonaceae**. Dicotyledons (Archichl. Geraniales). 2 gen. with 28 sp., placed in Vochysiaceae by Benth.-Hooker. See *Nat. Pfl.*

**Trillium** Linn. Liliaceae (VII). 15 sp. E. As., N. Am. Like Paris.

**Trinia** Hoffm. Umbelliferae (5). 7 sp. Eur., As., Medit. (1 Brit.).

**Triodia** R. Br. Gramineae (X). 20 sp. temp. (*T. decumbens* Beauv. in Brit.).

**Triopteris** Linn. Malpighiaceae. 3 sp. Caribbean Sea.

**Triosteum** Linn. Caprifoliaceae (II). 5 sp. Himal., E. As., N. Am.

**Triphasia** Lour. Rutaceae (X). 1 sp. China.

**Triplaris** Loebl. Polygonaceae (III. 6). 10 sp. trop. S. Am. All are said to harbour ants in their hollow stems (cf. *Cecropia*). Flr. cyclic (see order), diœcious. The 3 outer perianth-leaves grow into long wings which project beyond the fruit and aid in distribution.

**Tripsacum** Linn. Gramineae (I). 3 sp. trop. and subtrop. N. Am. *T. dactyloides* L. is a fodder grass. It is like *Euchlaena*, but with ♂ and ♀ flrs. in the same infl.

**Tripteris** Less. Compositae (IX). 32 sp. S. Afr. to Arabia. The fruit has three wings.

**Trisetum** Pers. Gramineae (IX). 50 sp. temp. *T. flavescens* Beauv. in Brit., a good forage grass.

**Triteleia** Dougl. = *Brodiaea* Sm.

**Triticum** Linn. Gramineae (XII). 15 sp. Medit., W. As. The spike-lets are 2—5-flowered and arranged in a dense spike. *T. vulgare*

Vill. is the wheat, of which numerous subspecies are cultivated, e.g. *T. polanicum* L. (Polish wheat), *T. durum* Desf., *T. Spelta* L. (spelt), *T. dicoccum* Schrank, *T. monococcum* L., &c. (see Körnicke and Werner, *Handb. d. Getreidebaues*, Bonn, 1885, or *Nat. Pfl.*; also Mueller's *Select Extratrop. Plants*). [For *T. repens* L. see *Agropyrum*.]

Wheat is subject to many diseases; one of the most interesting is rust, which shows as rusty streaks of spores upon the leaves (see Berberis).

**Tritonia** Ker-Gawl. = *Kniphofia* Moench.

**Triumfetta** Plum ex Linn. Tiliaceae. 60 sp. trop. Herbs or shrubs, often with extrafloral nectaries at the base of the leaves. The infl. is peculiar. On each internode there are usually at least three 3-flowered dichasial cymes. The first and oldest is opposite to the leaf; the rest stand alternately right and left between the first and the leaf. [See *Nat. Pfl.*]. The fruit is armed with hooked spines for animal-distribution.

**Triuridaceae**. Monocotyledons (Helobiaeae). 2 gen. with about 8 sp. trop. As. and Am. Saprophytes. See *Nat. Pfl.* Placed in Apocarpae by Benth.-Hooker.

**Trochodendraceae**. Dicotyledons (Archichl. Ranales). 3 gen. E. As. Placed in Magnoliaceae by Benth.-Hooker. See *Nat. Pfl.*

**Trollius** Linn. Ranunculaceae (2). 12 sp. N. temp. and Arctic. (*T. europaeus* L., the globe-flower, in Brit.) The 'sepals' completely cover in the flr., protecting the pollen from injury. The flr. is homogamous, and regularly fertilises itself, though cross-fertilisation may occur.

**Tropaeolaceae**. Dicotyledons (Archichl. Geraniales). Only genus *Tropaeolum* (q.v.). Placed in Geraniaceae by Benth.-Hooker, in Columniferae by Warming.

**Tropaeolum** Linn. Tropaeolaceae. 35 sp. S. Am., Mexico (Nasturtium or Indian cress of gardens). Most are herbs climbing by sensitive petioles (cf. Clematis), with compound or peltate leaves; some have tubers at the base of the stem. Flr. zygomorphic with a posterior spur formed by the axis under the posterior sepal. K 5, imbricate; C 5; A 4+4; G (3), 3-loc. with 1 ovule in each, anatropous, pendulous with micropyle facing upwards and outwards; style simple. Fruit a schizocarp, with no beak. Seed exalbuminous.

**Troximon** Nutt. Compositae (XIII). 24 sp. W. Am.

**Tsuga** Carr. Coniferae (Arauc. 1 b; see C. for genus characters). 6 sp. As. N. Am.: evergreen trees with the habit of Picea. *T. canadensis* Carr. is the Hemlock spruce, found in a large part of N. Am. and valued for its wood, bark (used in tanning), pitch (canada pitch), &c. *T. (Pseudotsuga) Douglasii* Carr. is the Douglas fir, forming large forests in the Rocky Mts. &c.

**Tubiflorae**. The 5th cohort (Engler) of Sympetalae (p. 140). The 4th cohort (Warming) of Sympetalae (p. 146).

**Tulbaghia** Linn. Liliaceae (IV). 10 sp. trop. and S. Afr.

**Tulipa** Linn. Liliaceae (V). 50 sp. N. temp. (tulip), esp. on the steppes of Cent. As. The seeds are flat, and the capsule, even when the flr. is pendulous, stands erect to prevent their escape except when shaken. Many are garden favourites.

**Tunica** Hall. Caryophyllaceae (I. 2). 20 sp. E. Medit.

**Turnera** Plum. ex Linn. Turneraceae. 57 sp. trop. and subtrop. Am., 1 Bourbon and Mauritius.

**Turneraceae.** Dicotyledons (Archichl. Parietales). 6 gen. with 88 sp. chiefly trop. Am. and Afr. Trees, shrubs and herbs, with alt. usually exstip. leaves, whose teeth are sometimes glandular. Flrs. usually solitary in the leaf-axils, ♂, regular, perigynous. K 5, imbricate, usually with a hemispherical swelling on inner side; C 5; A 5;  $\bar{C}$  (3), 1-loc. with parietal placentae; styles 3; ovules 3— $\infty$ , anatropous. Fruit a capsule, loculicidal. Seed with funicular aril, and copious endosperm. Nearly all the T. have dimorphic heterostyled flowers (cf. Primula). Many have extrafloral nectaries. Self-fertilisation occurs, in absence of insect visits, by the corolla withering and pressing the anthers and stigmas together. *Chief genus*: Turnera. Placed in Passiflorales by Benth.-Hooker, in Passiflorinae by Warming.

**Turraea** Linn. Meliaceae. 40 sp. trop., except Am.

**Turritis** Tourn. ex Linn. = Arabis Linn.

**Tussilago** (Tourn.). Linn. Compositae (VIII). 1 sp. Eur., N. Afr., As., *T. Farfara* L., colt's foot, common in Brit. The flrs. appear in spring before the leaves; the plant multiplies and hibernates by aid of underground offshoots. The flower-head is monœcious; in the centre are about 40 ♂ flrs., surrounded by about 300 ♀ flrs. The males retain the style, as usual, to act as pollen-presenter, but it has no stigmas. Honey is secreted in the ♂ flrs., but not in the ♀, so that the head altogether presents a very interesting example of division of labour. The ♀ flrs. being the outer ones are ripe before the ♂, and self-fertilisation is almost impossible.

**Tylophora** R. Br. Asclepiadaceae (II. 4). 40 sp. Indo-mal., Austr., Afr.

**Typha** Linn. Typhaceae. 12 sp. temp. and trop., in marshes; 2 in Brit. (reed-mace, cat's-tail, bulrush). The lower part of the stem is a thick rhizome; the upper part projects high out of the water and bears the infl., which is a dense spike, divided into two parts, the upper ♂ (usually yellow), the lower ♀ (brown). ♂ flr. of 2—5 sta., the connective projecting beyond the anthers; the flr. is enclosed in a number of hairs: the ♀ flr. is similarly enclosed, and is of 1 cpl. with 1 pendulous ovule, the micropyle towards the base or ventral side of the ovary. Flr. anemophilous. The fruits are achenes covered by the long downy hairs above mentioned, which aid in distribution. Seed albuminous; embryo straight.

**Typhaceae.** Monocotyledons (Pandanales). Only genus *Typha* (q.v.).



Placed (united to Sparganiaceae) in Nudiflorae by Benth.-Hooker, in Spadiciflorae by Warming.

**Typhonium** Schott. Araceae (VII). 15 sp., E. Ind., Austr.

**Ugni** Turcz. = *Myrtus* Tourn.

**Ulex** Linn. Leguminosae (III. 3). 20 sp. W. Eur., N. Afr.; 3 in Brit., *U. europaeus* L., *U. nanus* Forst., and *U. Gallii* Planch., the gorse, furze, or whin. These plants cover large areas of ground, especially on heaths (p. 198). The leaves are reduced in size, and many of the branches are reduced to green spines, so that the xerophytism is clearly marked. The flrs. explode like those of *Genista*, and the fruit explodes by the twisting up of its valves in dry air. The seeds in germination show interesting transition-stages from the usual compound leaf seen in the order to the needle-leaf of the mature plant (p. 113, and cf. *Acacia*).

**Ullucus** Caldas. Basellaceae. 1 sp. Andes, *U. tuberosus* Caldas. The lateral branches of the rhizome swell up into tubers like potatoes, and are used as food.

**Ulmaceae**. Dicotyledons (Archichl. Urticales). 13 gen. with 130 sp., trop. and temp. Trees with sympodial stems, bearing 2-ranked simple often asymmetrical leaves with stipules. Flrs. usually in cymose clusters, generally unisexual. P 4—5, free or united, sepaloïd, theoretically belonging to two whorls; A 4—5, opp. the perianth-leaves, in two whorls; G rudimentary in ♂ flr., in the ♀ of (2) cpls., sometimes 2-loc. but usually 1-loc., the second loc. aborting. Ovules 1 per loc., anatropous or amphitropous, pendulous. Style linear or bifid. Nut, samara or drupe. Seed usually with no endosperm. The wood of many *Ulmaceae* is useful. *Chief genera*: *Ulmus*, *Celtis*. United to *Urticaceae* by Benth.-Hooker, placed in *Urticiflorae* by Warming.

**Ulmaria** (Tourn.) Hill. Rosaceae (III. 8). 8 or 9 herbaceous species of the N. Hemisphere are sometimes separated from *Spiraea* under this name. They possess 2 seeds in each cpl., 1 only maturing, the fruits being achenes, while most sp. of the genus *Spiraea* have slightly adherent follicles and are shrubby (cf. *Rosaceae*). *Holodiscus discolor* Maxim. (*S. ariaefolia* Pursh) links *U.* to *Spiraea*. *U. palustris* Moench is *S. Ulmaria*, and *U. Filipendula* Hill is *S. Filipendula* of British Floras. The former is the meadow-sweet.

**Ulmus** (Tourn.) Linn. *Ulmaceae*. 16 sp. N. temp. and Mts. of trop. Asia. *U. montana* With. (wych elm) and *U. campestris* L. (elm) in Brit. The leaves are asymmetrical, one side being larger than the other (cf. *Begonia*). The flrs. are ♀ and come out before the leaves as little reddish tufts. If one of these tufts be examined, it will be found to be a short axis with a number of leaves, beginning 2-ranked at the base and going over to 5-ranked above. There are no flrs. in the axils of the lowest 10 or 12; in the axils of the upper leaves are flrs. arranged in small dichasial cymes (cf. *Betulaceae*), which are reduced, in *U. campestris* and others, to the one central flr. Each flr. has

P 4—8 and as many sta. with a 1-loc. ovary. [See art. Chalazogamiae.] The fruit is a samara, adapted to wind-dispersal. The elm supplies a very valuable timber.

**Umbellales** (Benth.-Hooker). The 15th cohort of Polypetalae (p. 143).

**Umbelliferae**. Dicotyledons (Archichl. Umbelliflorae). About 180 gen. with 1400 sp., cosmop., but chiefly N. temp. Many in Brit. Most of the order can be recognized at first glance by their habit; they are herbs with stout stems whose internodes are hollow, and alt. exstip. sheathing leaves with their blades much divided in a pinnate manner. A few, e.g. *Hydrocotyle* and *Bupleurum*, have entire leaves. The infl. is usually a compound umbel. At the top of the stalk, which bears each partial umbel, an involucre of bracts is often found (the bracts of the outer flrs.), and a similar larger involucre often occurs at the top of the main stalk bearing the compound umbel; the latter is sometimes termed the involucre in contradistinction to the *involucels* of the partial umbels. A terminal flr. often occurs, e.g. in *Daucus*. In a number of genera belonging to § A (below) simple umbels occur (e.g. *Astrantia*, *Hydrocotyle*); these are cymose in type (as the non-centripetal order of opening of the flrs. clearly shows) and are often arranged in cymose groupings, e.g. in *Sanicula*. *Eryngium* has a cymose head. Some sp. of *Xanthosia* and *Azorella* have such cymose infls. reduced to single flrs. These cymose infls., like the racemose, have often involucre of bracts.

Flr. usually ♂ and regular (see below), epigynous. K 5, usually very small, the odd sepal posterior; C 5 (rarely 6), usually white or yellow; A 5, with introrse anthers. On the top of the ovary is an epigynous disc prolonged upwards into the two short styles.  $\bar{G}$  (2), antero-posterior, 2-loc.; in each loc. one pendulous ovule, anatropous, with ventral raphe.

The massing of the flrs. into dense infls. makes them very conspicuous (cf. Compositae), and this is aided by the zygomorphism of the corolla so often seen; the outer petals of the outer flrs. of the umbel are drawn out (cf. Cruciferae) so as to form a sort of ray to the umbel. Honey is secreted by the epigynous disc; it is therefore accessible to all kinds of insects, and the order must be placed in the floral class A (p. 65), the lowest of all. [See p. 68.] The chief visitors are flies; bees form only a small proportion of the total. The flrs. are extremely protandrous; in most sp. the male stage is over in all the flrs. of an umbel before even the outer ones have begun the female stage.

The ovary ripens into a very characteristic fruit, a dry schizocarp, which splits down the septum between the cpls. into 2 mericarps, each containing one seed. The two are generally held together at first by a thin stalk (*carpopophore*) running up between them. The structure of the pericarp is of great importance in determining the genera. It is nearly always necessary to have ripe fruit in order to

identify one of the U. The shape is often important; the outer surface of each mericarp has generally 5 projecting *primary ridges*, two of which (the *lateral ridges*) are at the edges where the splitting takes place. Between these are sometimes found *secondary ridges*, 4 to each mericarp. In the furrows there are often found oil-cavities (seen as small openings in cross-section) known as *vittae*. The seed is often united to the pericarp; it is albuminous with a small embryo in the oily endosperm, which is usually cartilaginous in texture. The shape of the endosperm as seen in cross-section is another character of importance; it may be crescentic, or ventrally grooved, or concave on the ventral side. The fruits often show adaptations for distribution; in many genera (e.g. *Heracleum* and its allies) the mericarp is thin and flat, suited to wind-carriage; in others (e.g. *Daucus*) it is provided with hooks. See also *Scandix*.

Many U. are economically useful, but as a rule they are poisonous plants. See *Daucus* (carrot), *Pastinaca* (parsnip), *Apium* (celery), *Crithmum* (samphire), *Foeniculum*, *Archangelica*, *Carum*, *Ferula*, *Pimpinella*, *Coriandrum*, *Petroselinum*, &c.

*Classification and chief genera:*

- A. *HETEROSCIADIEAE* (simple or irregularly compound umbels; no vittae).
  1. *Hydrocotyleae* (fruit compressed laterally, or constricted at the narrow surface of junction): *Hydrocotyle*, *Azorella*.
  2. *Mulineae* (fruit with narrow surface of junction; mericarps sharp-angled at edge or almost winged): *Bowlesia*.
  3. *Saniculeae* (fruit with broad surface of junction, almost cylindrical or antero-posteriorly compressed): *Eryngium*, *As-trantia*, *Sanicula*.
- B. *HAPLOZYGIEAE* (umbels usually compound; furrows of fruit usually with vittae; primary ridges only).
  4. *Echinophoreae* (umbel with 1 sessile ♀ flr. in the centre, whose fruit is enclosed by the hardened stalks of the ♂ flrs.; 1 cpl. sterile): *Echinophora*.
  5. *Ammineae* (fruit laterally compressed, or constricted or grooved at both sides of surface of junction): *Conium*, *Bupleurum*, *Apium*, *Cicuta*, *Ammi*, *Carum*, *Sium*, *Pimpinella*, *Conopodium*, *Myrrhis*, *Chaerophyllum*, *Anthriscus*.
  6. *Seselineae* (fruit cylindrical or antero-posteriorly compressed, with broad surface of junction, the lateral ridges distinct or united to form a nerve-like corky margin which is not winged): *Seseli*, *Foeniculum*, *Crithmum*, *Oenanthe*, *Aethusa*, *Meum*, *Selinum*, *Levisticum*, *Angelica*, *Archangelica*.
  7. *Peucedanaceae* (fruit strongly compressed antero-posteriorly, the lateral ridges broadened into a wing or into a ridge which before separation of the mericarps is undivided): *Ferula*, *Dorema*, *Peucedanum*, *Heracleum*.

C. *DIPLOZYGIEAE* (umbels compound; fruit with primary and secondary ridges, the latter often the more strongly developed; vittae in the furrows or under the secondary ridges).

8. *Caucalineae* (ribs not winged or with deeply lobed wings or spines): *Coriandrum*, *Cuminum*, *Daucus*, *Caucalis*.

9. *Laserpitieae* (secondary ridges very marked and often extended into broad undivided or wavy wings): *Laserpitium*.

"Surface of junction" in the above characters refers to the surface by which the mericarps are united to one another.

[Placed in Umbellales by Benth.-Hooker, in *Umbelliflorae* by Warming.]

**Umbelliflorae.** The 23rd cohort (Engler) of *Archichlamydeae* (p. 139).

The 23rd cohort (*Warming*) of *Choripetalae* (p. 146).

**Umbilicus** DC. = *Cotyledon* Tourn.

**Uncaria** Schreb. (*Ouroparia* Aubl.). *Rubiaceae* (I. 6). 30 sp. trop. They climb by hooks, which are metamorphosed infl.-axes, and are sensitive to continued contact; after clasping they enlarge and become woody (p. 176).

**Uncinia** Pers. *Cyperaceae* (II). 30 sp. Austr., S. Am. The axis of origin of the fl. projects beyond the utricle in the form of a long hook, serving as a means of dispersal for the fruit.

**Uniola** Linn. *Gramineae* (x). 5 sp. Am. Useful as pasture.

**Unisexuales** (Benth.-Hooker). The 7th series of *Incompletae* (p. 145).

**Unona** Linn. f. *Anonaceae* (3). 40 sp. trop., As., Afr., Austr. Trees or shrubs, the latter climbing by recurved hooks which are infl.-axes (see p. 176). The fruit is an aggregate of stalked berries, which are constricted between the seeds like a lomentum.

**Uragoga** Linn. (incl. *Cephaelis* Sw. The boundaries of *U.*, *Psychotria* and allied genera are badly-defined. The grouping given by Schumann in *Nat. Pfl.* is followed in this book.) *Rubiaceae* (II. 15). 150 sp. trop. *U.* (C.) *Ipecacuanha* Baill. (*P. Ipecacuanha* Stokes) is the *Ipecacuanha* plant of Brazil; it is a herb with decumbent stem, and roots thickened somewhat like rows of beads. The root is used in medicine.

**Urena** Dill. ex Linn. *Malvaceae* (III). 3 sp. trop. Fruit a schizocarp, the individual cpls. provided with hooks.

**Urera** Gaudich. *Urticaceae* (I). 18 sp. trop. The stinging hairs are very powerful. The achene is enclosed in the persistent fleshy perianth, forming a pseudo-berry.

**Urginea** Steinh. *Liliaceae* (v). 24 sp. Eur., As., Medit., Afr. *U. Scilla* Steinh. (*U. maritima* Baker) is the squill, with very large bulbs. It is used in medicine.

**Uropappus** Nutt. = *Microseris* D. Don.

**Urospermum** Scop. *Compositae* (XIII). 2 sp. Medit.

**Urostigma** Gasp. = *Ficus* Tourn.

**Ursinia** Gaertn. *Compositae* (x). 54 sp. S. Afr., 1 sp. Abyssinia.

**Urtica** (Tourn.) Linn. Urticaceae (1). 30 sp. temp. (nettles). Herbs with opp. leaves and stipules (sometimes united in pairs between the petioles, as in Rubiaceae). The whole plant is usually covered with stinging hairs. All the various types of infl. are well illustrated by the 3 Brit. sp. In general the infl. is a dichasial cyme with tendency to a cincinnus by preference of the  $\beta$ -bracteole (p. 52). In *U. pilulifera* L. (Roman nettle) the  $\delta$  and  $\eta$  infls. spring side by side from each node, the  $\delta$  catkin-like, the  $\eta$  a pseudo-head. In *U. urens* L. (small nettle) a panicle is formed containing both  $\delta$  and  $\eta$  flrs. In *U. dioica* L. (large or common nettle) there is a panicle, but each sex is confined to its own plant. P 4; A 4, opp. to perianth leaves. The sta. are bent down inwards in the bud, and when ripe spring violently upwards and bend out of the flr., the anther at the same moment turning inside out, so that the loose powdery pollen is ejected as a little cloud, and may be borne by the wind to the stigma. The  $\eta$  flr. has a 1-loc., 1-ovuled ovary with a large brush-like stigma. Achene enclosed in the persistent perianth. The young tops are sometimes eaten like spinach. Useful fibre can be obtained from the stems of the common nettle by maceration.

**Urticaceae.** Dicotyledons (Archichl. Urticales). 41 gen. with 460 sp. trop. and temp. Most are herbs or undershrubs, with no latex, and with alt. or opp. stip. leaves. Infl. cymose often 'condensed' into pseudo-heads &c. (see Golenkin in *Flora*, 1894). Flrs. usually unisexual and regular. P 4—5, free or united, sepaloïd; sta. as many, bent down inwards in bud and exploding when ripe. Ovary 1-loc. with 1 erect basal orthotropous ovule. Fruit an achene. Seed usually with rich oily endosperm; embryo straight. Boehmeria, Urtica, Maoutia and others are used as sources of fibre.

*Classification and chief genera* (after Engler):

A. With stinging hairs. P (4—5) in  $\eta$ . Leaves alt. or opp.

1. *Urereae*: Urtica, Urera, Laportea.

B. No stinging hairs.

2. *Procridaeae* (stigma paint-brush-like): Pilea, Pellionia, Elatostema.

3. *Boehmerieae*: Boehmeria, Maoutia.

4. *Parietarieae*: Parietaria.

5. *Forskohleeae*: Forskohlea.

[Benth.-Hooker unite Ulmaceae (distinguished by infl., aestivation of sta., and ovule) and Moraceae (distinguished by presence of latex, and also usually by ovule, embryo, &c.) to Urticaceae, placing the order in Unisexuales. Warming places these 3 orders, separated, in Urticiflorae.]

**Urticales.** The 5th cohort of Archichlamydeae (p. 136).

**Urticiflorae** (Warming). The 4th cohort of Choripetalae (p. 146).

**Urvillea** H. B. et K. Sapindaceae (1). 10 sp. trop. and sub-trop. Am. Lianes like Serjania.

**Utricularia** Linn. Lentibulariaceae. 200 sp. trop. and temp., the latter all aquatic. 3 in Brit.; the commonest is *U. vulgaris* L., the bladder-wort. The morphology of *U.* is very interesting, for the usual distinctions drawn between root, stem and leaf cannot be applied here. The common bladder-wort is a submerged water plant with finely-divided leaves; it never has any roots, even in the embryo. The fls. project above the water on short shoots, and there are also short shoots with small leaves, which arise from the main axis and grow upwards to the water surface. Upon the ordinary submerged leaves are borne the bladders, curious hollow structures with trap-door entrances. Small Crustacea and other animals push their way into the bladders and are not able to escape, for the doors only open from outside. The plant takes up the products of the decay of the organisms thus captured; it is very doubtful whether any special ferment is secreted (p. 196). Other sp. of *U.* are land plants with peculiar runners, which develop in the moss or other substratum, on which they grow, and there bear the bladders. Others again, e.g. *U. montana* Poir., are epiphytes with water storage in tuberous branches. The leaves of all these forms are simple. Goebel (*Pflanzenbiol. Sch.*) has investigated the development of *U.* and finds that all these parts—leaves, bladders, runners, water-shoots, erect shoots, &c.—are practically equivalent to one another, and that the same rudiment at the growing point may give rise to any one of them, or that they may themselves change from one to another type. Similarly on germination a lot of spirally-arranged primary leaves are produced, and then one or two water-shoots appear laterally on the growing point, bearing no direct relation to the leaves in position, but apparently homologous with them. "Like *Genlisea*, *U.* possessed originally a leaf-rosette, ending with an infl., and consisting partly of bladders. Then were added the swimming water-shoots or (in land forms) runners, which though externally unlike leaves (since they develop indefinitely and produce leaves and infls.) yet are originally homologous with them." For further details see Goebel, *loc. cit.*

**Uvaria** Linn. Anonaceae (2). 60 sp. Indo-mal. Mostly lianes with recurved hooks (infl.-axes). The connective of the anther is usually leafy.

**Vaccaria** Medic. = *Saponaria* Linn.

**Vacciniaceae** (Benth.-Hooker) = Ericaceae (§ 111 *Vaccinioideae*).

**Vaccinium** Linn. (incl. *Oxycoccus* Tourn.). Ericaceae (111. 7). 100 sp. N. Hemisph. There are 4 sp. in Brit. *V. Myrtillos* L. the Whortle-, Bil- or Blae-berry, is extremely common in hilly districts. *V. uliginosum* L. is like it, but is found only at high levels. Both these have deciduous leaves and blue berries. *V. Vitis-Idaea* L., the Cow- or Whimberry (often called Cranberry by error), is also a mountain sp. and evergreen. *V. Oxycoccus* L., the Cranberry, is found in mountain bogs and is a trailing evergreen with leaf edges rolled back (p. 192). The fls. resemble those of *Erica*, both in structure and

mechanism, except that the ovary is inferior. They are largely visited by bumble-bees. The fleshy fruit is edible (used for jams, &c.) and is much distributed by birds. That of the N. Am. sp. *V. pennsylvanicum* Lam. is called blue huckleberry.

**Vahaea** Lam. = *Landolphia* Beauv.

**Vahlia** Thunb. Saxifragaceae (1). 4 sp. Afr., As., trop. and sub-trop. The fls. are in pairs (cymes); ovary inferior.

**Vaillantia** Tourn. ex Linn. Rubiaceae (11. 21). 2 sp. Medit.

**Valeriana** Tourn. ex Linn. Valerianaceae. 144 sp. Eur., As., Afr., Am. *V. officinalis* L. and *V. dioica* L. in Brit. (valerian). The fls. are protandrous. The calyx forms a pappus upon the fruit. The root of *V. edulis* Nutt. (N.W. Am.) is edible when cooked.

**Valerianaceae**. Dicotyledons (Sympet. Aggregatae). 8 gen. with 215 sp. Eur., As., Afr., Am. Herbs with exstip. leaves and dichasial branching. Fls. in cymose panicles &c., ♂ or unisexual, asymmetric, usually 5-merous. Calyx superior, little developed at the time of flowering, afterwards often forming a pappus as in Compositae. Corolla (5), often spurred at the base. Sta 1-4, epipetalous, alt. with petals; anthers introrse.  $\bar{G}$  (3); only 1 loc. is fertile, and contains 1 pendulous anatropous ovule. Achene. Seed exalbuminous. *Chief genera*: *Valerianella*, *Valeriana*, *Centranthus*. Placed in Asterales by Benth.-Hooker, in Rubiales by Warming.

**Valerianella** Tourn. ex Hall. (incl. *Plectritis* DC.) Valerianaceae. 51 sp. N. temp. and S. Am.; 4 in Brit. (corn-salad or lamb's lettuce). The seed-dispersal mechanisms show considerable variety. In *V. Auricula* DC. the sterile loculi of the fruit are inflated, in *V. vesicaria* Moench the calyx is inflated, in *V. discoidea* Loisel. it forms a parachute, whilst in *V. hamata* DC., *V. echinata* DC., and others it is provided with hooks.

**Vallisneria** Mich. ex Linn. Hydrocharitaceae. 2 sp. trop. and sub-trop. *V. spiralis* L. in Eur. is a dioecious submerged water-plant with ribbon leaves (p. 171). The ♂ fls. are borne in dense spikes enclosed in spathes; when ready to open the fls. break off and float up to the surface, where they open. The ♀ flr. is solitary on a very long stalk, which brings it to the surface of the water. It has a green perianth, an inferior ovary and 3 large stigmas. Pollination occurs on the surface of the water (cf. *Elodea*); and after it the stalk curls up into a close spiral, dragging the young fruit to the bottom of the pond to ripen. Vegetative propagation is effected by means of runners, rooting at the ends.

**Vancouveria** C. Morr. et Dcne. Berberidaceae. 2 sp. N.W. Am. United to *Epimedium* in *Nat. Pfl.*

**Vanda** Jones. Orchidaceae (31). 20 sp. Indo-mal. Epiphytes with fleshy leaves, sometimes cylindrical.

**Vandellia** Linn. (*Lindernia* All.) Scrophulariaceae (11. 8). 16 sp. trop. and sub-trop.

- Vangueria** Juss. Rubiaceae (11. 11). 30 sp. trop. Afr. and As.
- Vella** Linn. Cruciferae (11. 9). 3 sp. Spain and Algeria. Some are thorny, the thorns being stem structures.
- Velleia** Sm. Goodeniaceae. 12 sp. Austr. Ovary almost or quite superior.
- Vellozia** Vand. Velloziaceae. 40 sp. Brazil.
- Velloziaceae**. Monocotyledons (Liliiflorae). 2 gen. with 70 sp. Brazil, S. Afr., Madag. Xerophytes, chiefly living in rocky places or on the dry Campos. Perennial plants with dichotomously branched stems and leaves in rosettes (compare sp. of Aloe). The upper parts of the stems are clothed with the fibrous sheaths of old leaves, the lower parts with adventitious roots. The stem itself is thin, but its coating of roots may be several inches deep; the function of this covering appears to be the absorption of water. Water poured over the roots disappears as if into a sponge, and the plant is thus able to supply itself from the dew, &c. during the dry season. The leaves also show xerophytic structure (see Warming's paper, reviewed in *Bot. Centr.* 56, p. 94). Flrs. solitary, terminal, regular. P 3 + 3; A 3 + 3, or  $\infty$ , in bundles. Ovary inferior, 3-loc., with placenta in the form of lamellae, more or less peltately widened or thickened at the outer side. Ovules  $\infty$ . Capsule. Endosperm. *Genera*: Vellozia, Barbacenia. United to Amaryllidaceae by Benth.-Hooker and Warming (the chief points of difference are in the andrœceum and the placentae).
- Veltheimia** Gleditsch. Liliaceae (v). 3 sp. S. Afr.
- Ventilago** Gaertn. Rhamnaceae. 10 sp. trop., except Am. Some sp. climb by aid of hooks. The fruit resembles that of *Fraxinus*, having a wing for wind-distribution on its upper end. The wing is developed from the style after fertilisation.
- Veratrum** (Tourn.) Linn. Liliaceae (1). 10 sp. N. temp. There is a rhizome with leafy stem and racemes of flrs. The lower are ♀, but the upper are commonly ♂ by abortion (andromonœcism; see p. 89). Sometimes entire plants occur with ♂ flrs. only. The flrs. are protandrous. The seeds have a membranous border. Veratrin is obtained from the rhizome; that of *V. album* L. is known as white hellebore root.
- Verbascum** Tourn. ex Linn. Scrophulariaceae (1. 1). 160 sp. Eur., W. and Cent. As., N. Afr.; 6 Brit. sp. (mullein). Large perennial herbs with stout tap-roots, which show wrinkles like those of *Taraxacum* and from the same cause. The infl. is primarily racemose, but the lateral flrs. are often replaced by small condensed dichasia (cf. Labiatae). For floral structure and diagram see order. The flrs. are chiefly visited for pollen by bees and drone-flies. Those of several sp. were formerly officinal (and still are in some countries) under the name 'flores Verbasci'.
- Verbena** Linn. Verbenaceae (11). 80 sp. trop. and temp. *V. officinalis* L., the vervain, occurs in Brit. It was formerly in great repute as a



remedy in eye-diseases, its bright-eyed corolla, like that of *Euphrasia*, being supposed, under the old doctrine of signatures, to indicate its virtues in that direction. Several sp. are cultivated for their handsome and sweetly-scented flrs.

**Verbenaceae.** Dicotyledons (Sympet. Tubiflorae). About 67 gen. with 750 sp., almost all trop. and subtrop. Herbs, shrubs or trees. A number are lianes (p. 178), e.g. sp. of *Lantana*, *Clerodendron*, *Vitex*; xerophytes also, often armed with thorns, are frequent in the order. Leaves usually opp., rarely whorled or alt., entire or divided, exstip. The infl. may be racemose or cymose. In the former case it is most often a spike or head, often with an involucre of coloured bracts. The cymes are usually dichasia with a cincinnus tendency (cf. *Caryophyllaceae*); sometimes they also form heads.

Flr. usually ♂, zygomorphic, usually 5-merous. K (5) [or (4—8)], hypogynous; C (5), usually with narrow tube, rarely campanulate, often 2-lipped; A 4, didynamous, rarely 5 or 2, or of equal length, alt. with corolla-lobes, with introrse anthers; G usually (2), rarely (4) or (5). Ovary superior, usually 4-lobed, originally 2- (or more) loc., but very early divided into 4 (or more) loc. by the formation of a 'false' septum in each loc. (cf. *Labiatae*); placentae axile, with 2 ovules per cpl. (i.e. 1 in each loc. after septation); ovules ana- to orthotropous, basal, lateral or pendulous, but always with the micropyle directed downwards. Style terminal, rarely more or less sunk between the lobes of the ovary (contrast *Labiatae*); stigma usually lobed. Fruit generally a drupe, more rarely a capsule or a schizocarp. Seed usually exalbuminous.

Several of the V. are useful as sources of timber, e.g. *Tectona*. See also *Lippia*, *Priva*, *Clerodendron*, &c., for other economic uses.

*Classification and chief genera* (after Briquet):

A. Infl. spicate or racemose. Ovule usually basal, erect, anatropous.

I. *STILBOIDEAE* (endosperm): *Stilbe*.

II. *VERBENOIDEAE* (no endosperm): *Verbena*, *Lantana*, *Lippia*, *Priva*, *Petrea*, *Citharexylum*.

B. Infl. of cymose type. Cymes often united into panicles, corymbs &c.; if axillary, often reduced to 1 flr.

a. Ovule lateral (sometimes very high up) semi-anatropous. Ovary fully or imperfectly 4—10-loc.

III. *CHLOANTHOIDEAE* (fruit usually drupaceous, never capsular; endosperm): *Chloanthes*.

IV. *VITICOIDEAE* (as III, but no endosperm): *Callicarpa*, *Tectona*, *Vitex*, *Clerodendron*.

V. *CARYOPTERIDOIDEAE* (fruit capsule-like, 4-valved; the valves fall taking the stones with them or loosen them from the placental axis): *Caryopteris*.

b. Ovule apical, pendulous, orthotropous.

VI. *SYMPHOREMOIDEAE* (ovary 2-loc. to centre; fruit dry, 1-seeded): Symphorema.

VII. *AVICENNIOIDEAE* (ovary imperfectly 4-loc.; fruit capsular, 2-valved, 1-seeded; mangroves): Avicennia (only genus).

[Placed in Lamiales by Benth.-Hooker, in Nuculiferae by Warming.]

**Verbesina** Linn. Compositae (v). 70 sp. Am.

**Vernonia** Schreb. Compositae (1). 450 sp. Am., Afr., As. The style should be carefully examined, as it is one of the typical styles of the order (see classification of C.).

**Veronica** (Tourn.) Linn. (excl. *Paederota* L.). Scrophulariaceae (III. 10). 200 sp. extra-trop., many alpine. About 75 in Eur., 17 in Brit. (speedwell). The Brit. sp. are herbaceous (often woody below); the flrs. are in terminal or lateral racemes. The posterior sepal of the 5 typical of this order is absent, and the two posterior petals are united into one large one, so that the perianth is 4-merous (see order for floral diagram). The 2 sta. and style project horizontally from the rotate corolla. A small percentage of flrs. exhibit a different number of parts (e.g. 5 petals); see Bateson in *Linn. Soc. Journ.* XXVIII, 1891, p. 386. The fertilisation of the flr. in *V. Chamaedrys* L., the commonest Brit. sp., is performed chiefly by drone-flies. The style projects over the lower petal, while the two sta. project laterally. Honey is secreted at the base of the ovary and concealed by the hairs at the mouth of the short corolla-tube. Insects in alighting on the lower petal touch the style and then grasp the bases of the sta., thus causing the anthers to move inwards and dust the visitors' lower surface with pollen. Other sp. show similar mechanisms, but with more and more tendency to, and arrangements for, self-fertilisation, as the flr. is less conspicuous (Müller, *Fert. of Flrs.*). The peduncles stand close up against the main stem of the raceme whilst the flrs. are in bud, diverge as the flrs. open, and again close up as they wither (p. 101). The fruit is a capsule with a few flattened seeds suited to wind-distribution. In *V. arvensis* L. and other sp. that live in damp places, the capsule merely cracks as it dries and only opens so far as to allow the seeds to escape when thoroughly wetted; the seeds then become slimy (cf. *Linum*) and can only be distributed to a distance by water (see Macleod in *Bot. Jaarb.* 1. p. 91).

Many exotic sp. of *V.* are shrubby, with handsome spikes of flrs. and are often cultivated. In N. Z. the genus is one of the characteristic alpine plants; 64 sp. occur, of which 59 are endemic (p. 159). Some of these are small trees; most are shrubby (often dwarf). Many of these sp., e.g. *V. cupressoides* Hook. f., are xerophytes with reduced leaves closely appressed to the stem, so that the twigs closely resemble those of *Cupressus* and other Coniferae; in fact they have been described as Coniferae in systematic works.

**Vesicaria** Tourn. ex Adans. Cruciferae (IV. 17). 32 sp. Eur., Am.

**Viburnum** Linn. Caprifoliaceae (II). 100 sp. temp. and subtemp., chiefly As., and N. Am. The winter buds of some sp. are naked, i.e. have no scale-leaves. The outer fls. of the cymose corymb are neuter in some sp., e.g. *V. Opulus* L., the guelder-rose, having a large corolla, but at the cost of the essential organs. In the cultivated guelder-rose all the fls. are neuter.

**Vicia** Tourn. ex Linn. Leguminosae (III. 9). 120 sp. N. temp., and S. Am.; 10 in Brit. (vetch, tare). Most are climbers with leaf-tendrils. The floral mechanism is typical of many L. The pollen is early shed by the anthers into the apex of the keel; upon the style, below the stigma, is a brush of hairs which carries out the pollen when the keel is depressed (see order). *V. sativa* L. and many other vetches are valuable fodder plants; *V. Faba* L. is the broad bean, with its many varieties.

**Victoria** Lindl. Nymphaeaceae (III). 2 sp. trop. Am. *V. regia* Lindl. is the giant water-lily of the Amazon. The plant has the habit of a Nymphaea, but is of enormous size. The floating leaves may be 2 m. or more across; the edge is turned up to a height of several cm., and on the lower side the ribs project very far and are armed with formidable spines, perhaps of use as a protection against animals. The flr. resembles that of Nymphaea but is fully epigynous. The fruit also is similar and the seeds contain both endo- and peri-sperm. They are roasted and eaten in Brazil, under the name of Mais del aqua (water-maize). The plant is now cultivated in several gardens, e.g. Kew; it was discovered in 1801, but was not brought into general notice till 1837.

**Vigna** Savi. Leguminosae (III. 10). 40 sp. trop. *V. sinensis* Endl. is the cherry-bean or cow-pea (trop. As.), whose pods are eaten like French beans.

**Vilfa** Beauv. = Sporobolus R. Br.

**Villarsia** Vent. Gentianaceae (II). 1 sp. Cape Col. and 9 Austr. The water plant often known under this name is a Limnanthemum.

**Vinca** Linn. (incl. *Lochnera* Rchb.). Apocynaceae (I. 3). 5 sp. Eur. and Orient (*Vinca* proper; sta. and stylar head hairy) and 3 sp. E. Ind., Madag., Am. (*Lochnera*; sta. and stylar head not hairy). Of the latter *V. rosea* L. is a favourite in conservatories. *Vinca minor* L. and *V. major* L., the periwinkles, occur in England, but are not true natives. The anthers stand above the stigmatic disc, but the stigma itself is on the under surface of the disc, so that self-fertilisation is not caused as the insect's tongue enters the flr.

**Vincetoxicum** Rupp. = Cynanchum Linn.

**Viola** Tourn. ex Linn. Violaceae. 200 sp. cosmop., chiefly N. temp. Several are common in Brit. *V. odorata* L. and *V. canina* L. are the sweet and dog violets, *V. tricolor* L. the pansy or heart's-ease, and others are also well known. Many sp. and varieties are in cultivation. They are herbaceous plants with large stipules, on which glands

sometimes occur. The flrs. stand usually one in each axil; sometimes (e.g. *V. tricolor*) a vegetative shoot arises above the flr. in the same axil. The chief interest centres in the flrs. The introrse anthers form a close ring round the ovary, below the style, which ends in a variously shaped head on whose anterior surface is the stigma, often a hollow pocket. The lower petal forms a landing-place and is often prolonged backwards into a spur, in which collects honey, secreted by processes projecting into it from the lower sta. These flrs. are as a rule incapable of self-fertilisation. In *V. tricolor* the pollen is shed on to the anterior petal, and the lower edge of the stigma is guarded by a flap which the insect, when withdrawing, closes; and thus the flower's own pollen is prevented from reaching the stigma. The small-flowered subspecies *V. arvensis* Murr. has not this flap and fertilises itself. In *V. odorata* the stigma is merely the bent-over end of the style, and is first touched as the insect enters. The size, colour, &c., of the flower of this sp. and of *V. canina* render them adapted to bees.

In many sp., e.g. *V. canina*, *V. odorata*, *V. sylvestris* Lam., the flrs. are but rarely visited, and very little seed is set. They usually flower early in the season; later on appears a second form of flr. on the same plant. These are the cleistogamic flrs., which never open, but set seed by self-fertilisation (see p. 92). In *V. canina* this flr. looks like a bud; the sepals remain shut, there are 5 very minute petals, 2 anterior sta. with anthers containing a little pollen (only just enough for fertilisation—there is no waste as in open flrs.), and 3 other abortive sta.; the pistil is much as usual. The anthers are closely appressed to the stigma; the pollen-grains germinate within them, and the tubes burrow through the anther-walls into the stigma. *V. odorata* has very similar flrs., but with all 5 sta. fertile. The production of these flrs. ensures the setting of a fair amount of seed. Their appearance is partly dependent on shade (they are always well shaded by the leaves &c.), for a reduction of the intensity of the light causes the plant to produce cleistogamic flrs. only (see Vöchting in *Prings. Jahrb.* 1893). It is however likely that other factors (cold, degree of moisture, soil &c.) also affect the result; and the production of these flrs. is apparently hereditary though very variable.

The fruit is a 3-valved capsule; the seeds are very hard and slippery. One placenta with its seeds remains attached to each valve; as this dries it bends upwards into a U-shape, squeezing the seeds against one another and shooting them out (see p. 112, and cf. *Claytonia*, *Buxus*).

**Violaceae.** Dicotyledons (Archichl. Parietales). 15 gen. with 300 sp. cosmop. Annual or perennial herbs, or shrubs. Leaves alt., stipulate, usually undivided. Flrs. 1 or 2 in each axil, in usually racemose infls., bracteolate, ♂, usually zygomorphic. K 5, persistent; C 5, hypogynous, usually zygomorphic, the anterior petal often spurred to hold the honey, with descending aestivation; A 5, alt. with petals, hypo-

gynous, forming a ring round the ovary; filament very short, anther introrse, connective usually with membranous prolongation.  $\underline{G}$  (3), 1-loc. with 1— $\infty$  anatropous ovules on each of the parietal placentae. Style simple. Fruit a 3-valved loculicidal capsule. Endosperm. *Chief genera*: Alsodeia, Viola. Placed in Parietales by Benth.-Hooker, in Cistiflorae by Warming.

**Violarieae** (Benth.-Hooker) includes Violaceae and the *Sauvagesieae* of Ochnaceae.

**Viscaria** Riv. ex Rupp. = *Lychnis* Tourn. *V. viscosa* Aschers. = *L. Viscaria*.

**Viscum** Tourn. ex Linn. Loranthaceae (2). About 20 sp. universal in the Old World. *V. album* L. in Brit. (mistletoe). It is a semiparasitic shrubby evergreen, growing on apple, hawthorn, oak, &c., and drawing nourishment from its host by suckers. It is repeatedly branched in a dichasial manner, the central stalk usually ending in an infl. Each branch bears two green leathery leaves, and represents a year's growth. The unisexual dioecious flrs. are in groups of three. There is no calyculus. The sta. is completely fused to the perianth-leaf. Pollen-sacs very numerous. Ovary as usual in the order. The flrs. secrete honey and are visited by flies. Fruit a pseudo-berry. The layer of viscin prevents the bird that eats the berry from swallowing the seed, which it scrapes off its bill onto a branch, where it adheres and germinates. [See *Nat. Pfl.* or *Treas. of Bot.*]

**Vitaceae** (Ampelidaceae). Dicotyledons (Archichl. Rhamnales). 11 gen. with 450 sp. mostly trop. and subtrop. Climbing or rarely erect shrubs, with alt. stip. leaves. Infl. cymose, usually complex; bracteoles present. Flr. regular,  $\varnothing$  or not. K (4—5), small and cup-like, very slightly lobed; C 4—5, valvate, often united at the tips and falling off as a hood upon the opening of the bud; A 4—5, opp. to the petals, at the base of a hypogynous disc, with introrse anthers.  $\underline{G}$  usually (2), rarely 3—6, multi-loc. with usually 2 collateral anatropous ovules, which are erect with ventral raphe. Berry. Endosperm; embryo straight. *Vitis* is economically important. *Chief genera*: *Vitis*, *Leea*. Placed in Celastrales by Benth.-Hooker, in Frangulinae by Warming.

**Vitellaria** Gaertn. f. Sapotaceae (1). 15 sp. trop. Am. *V. mammosa* Radlkf. is the marmalade tree, cultivated in the tropics for its fruit.

**Vitex** Tourn. ex Linn. Verbenaceae (1v). 60 sp. trop. and temp.

**Vitis** (Tourn.) Linn. (incl. *Ampelopsis* Michx., *Cissus* Linn., *Quinaria* Rafin.). Vitaceae. 350 sp. trop. and warm temp. The vines are climbing plants, with tendrils which represent modified infls.; the stem is usually regarded as a sympodium (p. 35), each axis in turn ending in a tendril, but there has been much argument upon the subject (see *Nat. Pfl.*). The tendril may attach itself by the ordinary coiling method, or may be negatively heliotropic and thus force its way into the crevices of the support; in these

crevices the tips of the tendrils form large balls of tissue, the outer parts of which become mucilaginous and cement the tendril to its support. *V. vinifera* L. (Orient, N.W. India) is the cultivated grape; when dried the fruits form raisins. *V. aestivalis* Michx. (summer-grape) and *V. Labrusca* L. (fox-grape) are N. Am. sp. which have been largely introduced into Eur., as they resist the attacks of the Phylloxera better than the Eur. sp. *V. (A.) hederacea* Ehrh. (N. Am.) and *V. inconstans* Miq. (*A. Veitchii* hort.; Japan) are the virginian creepers so often cultivated.

**Vittaria** Sm. Polypodiaceae. 10 sp. trop. and sub trop.

**Voandzeia** Thou. Leguminosae (III. 10). *V. subterranea* Thou. is the only sp. (trop. Afr.); it buries its young fruits like *Arachis*. The seed is edible and the plant is largely cultivated.

**Vochisia** Juss. (*Vochysia* Poir.). Vochysiaceae. 54 sp. trop. Am.

**Vochysiaceae**. Dicotyledons (Archichl. Geraniales). 5 gen. with 100 sp., trop. S. Am. Trees and shrubs. See *Nat. Pfl.* for details. Placed in Polygalinae by Benth.-Hooker.

**Vouacapoua** Aubl. = *Andira* Lam.

**Voyria** Aubl. (incl. *Leptachmos* Cham. et Schlecht., *Voyriella* Miq.). Gentianaceae (I). 23 sp. trop. Am. and Afr.

**Vriesia** Lindl. = *Tillandsia* Linn.

**Wachendorfia** Burm. Haemodoraceae. 7 sp. Cape Colony. Transverse zygomorphism is found in the flr. but is not obvious on account of the twisting of the stalk.

**Wahlenbergia** Schrad. (incl. *Hedraecanthus* Griseb.). Campanulaceae (I. 1). 80 sp. chiefly S. temp., where the genus to some extent replaces *Campanula*. 12 sp. are found in Eur. and As. Minor, one of which, *W. hederacea* Rchb. (*Campanula hederacea* L.), the ivy-leaved bell-flower, occurs in Brit. Flr. like that of *Campanula*. Capsule loculicidal (the chief difference between these two genera).

**Waldsteinia** Willd. Rosaceae (III. 6c). 4 sp. N. temp.

**Wallichia** Roxb. Palmae (IV. 6). 3 sp. Himal. to Malaya.

**Washingtonia** H. Wendl. Palmae (I. 2). 2 sp. S. Calif., Arizona. Included in *Pritchardia* in *Nat. Pfl.*

**Washingtonia** Winkl. = *Sequoia* Endl.

**Watsonia** Mill. Iridaceae (III). 11 sp. Afr., Madag.

**Wedelia** Jacq. Compositae (V). 60 sp. trop. and warm temp.

**Weigelia** Pers. = *Diervilla* Tourn.

**Weinmannia** Linn. Cunoniaceae. 70 sp. S. Am., Madag., N. Z., Austr., Polynes.

**Wellingtonia** Lindl. = *Sequoia* Endl.

**Welwitschia** Hook. f. Gnetaceae. 1 sp., *W. mirabilis* Hook. f., a remarkable plant discovered by Welwitsch in Damaraland (W. trop. Afr.) and described by Hooker in *Trans. Linn. Soc.* 1863 (q.v.). Specimens may be seen in most of our museums. The plant grows for a century or more and has a peculiar habit. The stem is stout,

with a two-lobed form and almost circular in section. It narrows downwards into a stout tap-root. At the edges of the two lobes are two grooves, from each of which springs a leaf. These leaves are the first pair after the cotyledons and are the only leaves the plant ever has; they go on growing at the base throughout its life, wearing away at the tips and often becoming torn down to the base. The stem continues to grow in thickness, and exhibits concentric grooves upon the top surface. In the outer (younger) of these grooves the flrs. appear, in panicles of small spikes; they are covered by bracts which become bright red after fertilisation. The flrs. are unisexual. In the ♂, there is a perianth of 2 + 2 leaves, the outer whorl transverse to the bract; sta. 6, united below, with 3-loc. anthers; gynoeceum rudimentary, but with the integument of the ovule looking like a style and stigma. In the ♀, the perianth-leaves are fused into a tube, and are equivalent to the two outer leaves of the ♂; there is no trace of sta. Ovule 1, erect, with the integument drawn out beyond it. Seed with endosperm and perisperm, enclosed in the perianth which becomes winged. [See *Gymnospermae*.]

**Werneria** H. B. et K. Compositae (VIII). 30 sp. Andes, Himal., Abyssinia.

**Westringia** Sm. Labiatae (II). 12 sp. Austr.

**Whipplea** Torr. Saxifragaceae (III). 2 sp. West U. S.

**Whitlavia** Harv. = *Phacelia* Juss.

**Widdringtonia** Endl. = *Callitris* Vent.

**Wigandia** H. B. et K. Hydrophyllaceae. 6 sp. Mts. of trop. Am.

**Willughbela** Roxb. Apocynaceae (I. 1). 10 sp. Malaya, Ceylon, Assam.

**Winterana** Linn. = *Canella* P. Br.

**Winteranaceae** = *Canellaceae*.

**Wistaria** Nutt. (*Bradburya* Rafin. in part, *Kraunhia* Rafin.). Leguminosae (III. 6). 5 sp. China, Japan, N. Am. *W. chinensis* DC. (China) is a climbing shrub often grown on houses in Brit. for its beautiful and sweet-scented flrs. The floral mechanism is like that of *Trifolium*. The pods explode violently.

**Witnesia** Thunb. Iridaceae (II). 1 sp. Cape Colony. Several sp., cultivated as *W.*, belong to *Aristea* and other genera.

**Wolflia** Horkel. Lemnaceae. 6 sp. trop. and temp. *W. arrhiza* Wimm. in Brit. (the smallest of flowering plants).

**Woodfordia** Salisb. Lythraceae. 2 sp., one Abyss., and 1 (*W. floribunda* Salisb.) Madag., Ind., China, Timor.

**Woodsia** Br. Polypodiaceae. 15 sp. alpine and arctic. *W. ilvensis* Br. and *W. hyperborea* Br. are rare alpine ferns in Brit.

**Woodwardia** Sm. Polypodiaceae. 6 sp. N. Hemisph.

**Wormia** Rottb. Dilleniaceae. 20 sp. trop. As., Afr. Included in *Dillenia* in *Nat. Pl.*

**Wrightia** R. Br. Apocynaceae (II. 5). 10 sp. trop., Afr., As., Austr.

**Wulfenia** Jacq. Scrophulariaceae (III. 10). 3 sp. Eur., As.

**Wyethia** Nutt. Compositae (v). 12 sp. western N. Am.

**Xanthium** (Tourn.) Linn. Compositae (v). 4 sp. temp. and trop. They have been so widely distributed by man (unintentionally) that it is hard to discover their native place. The flrs. are in unisexual heads, which are single or in axillary cymes, the ♂ at the ends of the branches. The ♀ head has 2 flrs., enclosed in a prickly gamophyllous involucre, only the styles projecting from it through openings in the two horns of the involucre. The fruits are enclosed in the hard woody involucre, which is covered with hooks and is admirably suited to animal-distribution. One sp. has gradually spread in this way from the East of Europe. "In 1828 it was brought into Wallachia by the Cossack horses, whose manes and tails were covered with the burrs. It travelled in Hungarian wool, and in cattle from the same region, to Regensburg, and on to Hamburg, appearing here and there on the way." Strenuous laws for its extirpation have been enforced in South Africa, where at one time it had become so common as seriously to impair the value of the wool.

**Xanthochymus** Roxb. = *Garcinia* Linn.

**Xanthophyllum** Roxb. Polygalaceae. 40 sp. Indo-mal. Ovary 1-loc. with parietal placentae. Nut one-seeded.

**Xanthorrhiza** Marshall = *Zanthorhiza* L'Hérit.

**Xanthorrhoea** Sm. Liliaceae (III). 11 sp. Austr. The best known is *X. hastilis* R. Br., the grass-tree or black-boy, a characteristic plant of the Austr. vegetation (p. 203). It has the habit of an Aloe or Dasyliirion, with a long bulrush-like spike of flrs. (really cymose as may be seen from the many bracts on the individual flr.-stalks). Perianth sepaloid (*X.* is placed in Juncaceae by Benth.-Hooker). From the bases of the old leaves trickles a resin, used in making varnish, sealing-wax, &c.

**Xanthosia** Rudge. Umbelliferae (1). 17 sp. Austr. The umbels in some sp. are reduced to single flrs.

**Xanthosoma** Schott. Araceae (VI). 20 sp. trop. Am. Large herbs (fig. in Kerner's *Nat. Hist.*). *X. appendiculatum* Schott has a second blade at the back of the leaf, united with the chief one along the midrib, and much smaller than it. A pocket is thus formed whose use is unknown. The phenomenon is due to a tangential division of the embryonic leaf. Flrs. monœcious, naked; sta. in syndria.

**Xanthoxylum** J. F. Gmel. = *Zanthoxylum* Linn.

**Xeranthemum** Tourn. ex Linn. Compositae (x1). 6 sp. Medit., Orient.

**Xiphion** Tourn. ex Mill. = *Iris* Tourn.

**Xylomelum** Sm. Proteaceae (II). 4 sp. Austr. The fruits are known as wooden pears, being of the size of a large pear, and looking at first glance as if they were edible. Inside is found a thick wall of woody tissue enveloping the winged seeds. It splits open along the posterior side. This sort of fruit is found in several Proteaceae and is looked on as an arrangement for protection of the seeds from the drought (p. 183).



**Xylophylla** Linn. = *Phyllanthus* Linn. (the sp. with phylloclades).

**Xylopia** Linn. Anonaceae (6). 60 sp. trop.

**Xylopleurum** Spach = *Oenothera* Linn.

**Xylosma** Forst. f. = *Myroxylon* Forst.

**Xyridaceae.** Monocotyledons (Farinosae). 2 gen. (*Xyris*, *Abolboda*) with 50 sp. trop. and subtrop., mostly Am. Mostly marsh plants, herbaceous, tufted, with radical sheathing leaves and spikes or heads of  $\frac{1}{2}$  fls. Perianth heterochlamydeous. K 3, the lateral sepals small, the anterior large, enclosing the corolla; C (3). Sta. 3, epipetalous, the outer whorl absent or represented by staminodes. Ovary 1-loc. or imperfectly 3-loc., with parietal or free basal placentation and  $\infty$  orthotropous ovules. Embryo small, in mealy endosperm. Placed in Coronarieae by Benth.-Hooker, in Enantioblastae by Warming. [See review in *Bot. Gaz.* 1893, p. 313.]

**Xyrideae** (Benth.-Hooker) = Xyridaceae.

**Xyris** Gronov. ex Linn. Xyridaceae. 40 sp. trop. and subtrop.

**Yucca** Dill. ex Linn. Liliaceae (vi). 20 sp. Southern U.S., Mexico, &c. Many are hardy in this country (Adam's needle). The stem is short, growing in thickness, and branching occasionally (cf. *Draecena*); at the end is a rosette of leaves, the old ones dying off below. The leaves are fleshy and pointed. The fls. are large and white and form a big panicle. Their chief interest is the very remarkable mode of pollination (for details and figures see Riley in *3rd Ann. Rep. Missouri Bot. Gdn.* 1892). This is one of the few cases of mutual dependence and adaptation of a single flr. and a single insect—*Pro-nuba*, a moth. The white flr. emits its perfume especially at night, and is then visited by the moths. The female has a long ovipositor with which she can penetrate the tissue of the ovary of the flr., and possesses peculiar maxillary tentacles confined to the genus, which are prehensile and spinous. "Her activity begins soon after dark, but consists, at first, in assiduously collecting a load of pollen. She may be seen running up to the top of one of the stamens.... The maxillary palpi are used in this act very much as the ordinary mandibles are used in other insects, removing or scraping the pollen from the anthers towards the tentacles. After thus gathering the pollen she raises her head and commences to shape it into a little mass or pellet...." She repeats the operation on several fls., until she has a pellet about thrice as large as her head. The moth then flies to another flr. and proceeds to deposit a few eggs in the ovary, piercing its wall with her ovipositor. Having done this she climbs to the top and presses the ball of pollen that she has gathered into the stigma. The result is that the ovules are fertilised, but they are so numerous that there are plenty for the larvae to feed upon and also to reproduce the plant.

The leaves of *Y. filamentosa* L. and other sp. furnish an excellent fibre (cf. *Agave*).

**Zahlbrucknera** Rchb. Saxifragaceae (1). 1 sp. Europe.

**Zalacca** Rumph. Palmae (III. 5). 10 sp. Indo-mal.

**Zaluzania** Pers. Compositae (v). 8 sp. Cent. Am.

**Zaluzianskya** F. W. Schmidt. Scrophulariaceae (II. 7). 16 sp. S. Afr.

**Zamia** Linn. Cycadaceae. 30 sp. trop. Am.

**Zamioculcas** Schott. Araceae (1). 1 sp. trop. Afr., Bourbon. Leaves pinnate.

**Zannichellia** Mich. ex. Linn. Potamogetonaceae. 1 sp. *Z. palustris* L., cosmop. It grows in fresh or brackish water, and has the habit of a small-leaved Potamogeton. Flrs. monœcious; the ♀ is terminal, and from the axil of its lower bracteole springs the ♂. From the axil of the upper a new branch may arise, bearing ♀ and ♂ flrs. again. The ♂ flr. consists of 1 or 2 sta., the ♀ of usually 4 cpls., surrounded by a small cup-like perianth. Pollination occurs under water as in *Zostera*, but the pollen is spherical.

**Zanonia** Linn. Cucurbitaceae (1). 2 sp., *Z. indica* L. (E. Ind. to New Guinea) and *Z. macrocarpa* Blume (Sunda Is.). The latter has enormous flat winged seeds which float very well in the air, and are remarkably like the seeds of many Bignoniaceae.

**Zantedeschia** Spreng. = *Richardia* Kunth.

**Zanthorhiza** L'Hérit. Ranunculaceae (2). 1 sp. Atlantic N. Am. Flrs. 5-merous throughout, and polygamous.

**Zanthoxylum** Linn. (incl. *Fagara* Linn.). Rutaceae (5). 140 sp. trop. and N. Am., As. Several are cultivated in shrubberies. *Z. piperitum* DC., the Japan pepper, yields fruits used as a condiment. The bark of *Z. fraxineum* Willd. (prickly ash or toothache-tree) is used in Am. as a remedy for toothache. The prickly stems of *Z. Clava-Herculis* L. are used as walking sticks.

**Zauschneria** Presl. Onagraceae (II). 1 sp. Calif., Mexico.

**Zea** Linn. Gramineae (1). 1 sp., *Zea Mays* L., the maize or Indian corn, apparently originally a Mexican sp., but now cultivated in most trop. and subtrop. regions. It is a tall annual grass, with terminal ♂ infl. and ♀ infls. in the axils of the foliage-leaves. The ♂ spikelets are borne in pairs, and are 2-flowered. The ♀ infl. forms a 'cob' with long filamentous stigmas hanging out at the end (the flrs. are pollinated by wind). The cob is enveloped when young by large spathe-leaves, and consists of combined spikes; each two rows of flrs. visible on its surface correspond to one spike of flrs. The cultivated forms are 8-, 10-, 12-, or 24-rowed. This should be compared with *Euchlaena*, in which the spikes are distinct and form a tuft. Each spike consists of one-flowered spikelets. The fruit is the familiar maize-seed, in which the structure of a grass-fruit can easily be made out; the embryo occupies the white portion near the pointed end.

Next to rice, maize is the most important cereal; it is termed corn in the U.S., like wheat in England, oats in Scotland. The grain is made into flour (Indian meal) or cooked without grinding; green corn

(unripe cobs) forms a favourite vegetable; the leaves are useful as fodder, the dry cobs as firing; the spathes are used in paper-making, and so on. [See Harshberger's monograph (botanical and economic) in *Contrib. from the Bot. Laboratory of the Univ. of Pennsylvania* 1. 1893.]

**Zelkova** Spach. Ulmaceae (11). 4 sp., 1 each in Crete, Caucasus, China, Japan. The timber of the last two is valuable for turning &c. [Urticaceae, Benth.-Hooker; see Ulmaceae.]

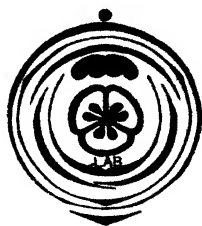
**Zephyranthes** Herb. Amaryllidaceae (1). 30 sp. trop. Am.

**Zeuxine** Lindl. Orchidaceae (4). 20 sp. trop. Afr. to E. Ind.

**Zingiber** Adans. Zingiberaceae. 20 sp. E. Ind., Malay Arch., China, Japan, Polynes., Mascarenes. The labellum is large; opp. to it are the style and the petaloid fertile sta. The stigma has many rays. *Z. officinale* Rosc. is the ginger; it is always reproduced by vegetative methods, and is now quite sterile (cf. *Musa*). It is largely cultivated; the rhizomes are dug up and killed by immersion in boiling water. According to whether the rind is or is not scraped off, the product is known as 'coated' or 'scraped' ginger.

**Zingiberaceae**. Monocotyledons (Scitamineae). 24 gen. with 275 sp. trop., chiefly Indo-mal. Perennial herbs usually with sympodial fleshy rhizomes and often with tuberous roots. The aerial stem, if any, is short; sometimes an apparent stem is formed as in *Musa* by the rolled-up leaf-sheaths. Leaves 2-ranked, with short stalks and sheathing bases. At the top of the sheath is a characteristic ligule (cf. Gramineae). Flrs. in racemes, heads, or cymes. Their morphology has been much discussed (see Eichler's *Bluthendiag.* or *Nat. Pfl.*). The bracteole is often sheathing (as in fig.). K (3), the odd one anterior, C 3, usually different in colour and texture from the outer perianth-leaves. Of the possible 6 members of the androecium (two whorls), the posterior one of the inner whorl is present as a fertile stamen, and the other two of this whorl are united to form the petaloid *labellum* (not equivalent to that of Orchids); the anterior sta. of the outer whorl is always absent; the other two may be absent (as in *Renealmia*) or may be present as large leafy staminodes right and left of the fertile sta. (compare carefully with Cannaceae and Marantaceae).  $\bar{G}$  (3), 3-loc., with  $\infty$  anatropous or semi-anatropous ovules. Fruit usually a loculicidal capsule. Seeds with perisperm. The order contains several economic plants; see *Curcuma*, *Costus*, *Alpinia*, *Zingiber*, *Amomum*, *Elettaria*.

*Chief genera*: *Curcuma*, *Hedychium*, *Costus*, *Alpinia*, *Renealmia*, *Zingiber*, *Amomum*, *Elettaria*, *Globba*, *Mantisia*. Placed in Sci-



Floral diagram of *Renealmia*, modified from Eichler, showing bract, sheathing bracteole, calyx, corolla, labellum (LAB), &c.

tamineae by Warming; Benth.-Hooker unite all the orders—Z., Musaceae, Cannaceae, and Marantaceae—into one order under the name of Scitamineae.

**Zinnia** Linn. Compositae (v). 12 sp. N. Am., favourite border plants. Leaves opp. or whorled. Fruit winged.

**Zizania** Gronov. ex Linn. Gramineae (vi). 2 sp. Am., N.E. As., *Z. aquatica* L. (*Hydrophyrum esculentum* Link), Canada rice, is used as a cereal by the N. Am. Indians.

**Zisiphora** Linn. Labiatae (vi. 8). 12 sp. Medit., Asia.

**Zizyphus** Tourn. ex Linn. Rhamnaceae. 40 sp. Indo-mal., trop. Am., Afr., Austr., Medit. The stipules are often represented by thorns, one of which is sometimes recurved whilst the other is straight (cf. *Paliurus*); occasionally only one is developed. *Z. chloroxylon* Oliv. (cogwood; Jamaica) yields a hard tough wood, used for cogs in machinery. The fruits of many sp. are edible; those of *Z. Lotus* Lam. (Medit.) are said to be the Lotus fruits of antiquity; those of *Z. vulgaris* Lam. (Orient &c.) are known as French jujubes; those of *Z. Joazeiro* Mart. are used in Brazil as fodder for cattle during the dry season. *Z. Spina-Christi* Willd. is said to have furnished the crown of thorns (cf. *Paliurus*).

**Zostera** Linn. Potamogetonaceae. 5 sp. temp., subarct., subtrop., growing in salt water on gently sloping shores (p. 188). *Z. marina* L. and *Z. nana* Roth in Brit. (eel-grass or grass-wrack). The lower part of the stem creeps, rooting as it advances along the ground, and has ordinary monopodial branching; the branches grow upwards into the water and exhibit sympodial branching, complicated by union of the axillary shoot to the main shoot for some distance above its point of origin. This is most easily seen in the infl. region; the branching is that of a rhipidium (p. 53), but the shoot II, which springs from the axil of a leaf on shoot I, is adnate to I up to the point at which the first leaf is borne on II; this leaf occupies the angle between the two shoots where they separate. Shoot I (and II, III, &c. successively) is pushed aside and bears an infl. (See Eichler's *Blüthendiag.* or *Nat. Pfl.* for details and figs.) The leaves are long, linear, and sheathing at the base.

The infl. is a flattened spadix, enclosed at flowering time in a spathe (the sheath of the uppermost leaf). This is open down one side, and on the corresponding side of the spadix the flrs. are borne, the essential organs forming two vertical rows, each composed of a cpl. and a sta. alternately. On the outer side of the spadix next the cpl. is often a small leaf (the *retinaculum* of systematic works). The midrib of the cpl. faces outwards. Each cpl. contains one ovule and has two flat stigmas. The sta. consists of two half anthers, joined by a small connective. It is difficult to decide what is the actual 'flower' in this plant; the usual view is that

|      |      |      |
|------|------|------|
| ret. | cpl. | sta. |
|      | sta. | ret. |
| ret. | cpl. | sta. |

each sta. with the cpl. on the same level with it forms a flr., the retinaculum representing the bract.

Fertilisation occurs in a peculiar way, *Z.* being one of the water plants most completely modified from the ancestral land-plant type (see p. 169). The flr. is submerged like the rest of the plant. The pollen grains are long threads, of the *same* specific gravity as salt water, so that when they are discharged they float freely at any depth. The stigmas are very large, and thus have a good chance of catching some of the grains. The whole mechanism is very similar in principle to that of a wind-fertilised plant. The fruit is an achene. Delpino looks upon *Z.* as an Aroid, adapted to a submerged existence. In winter it hibernates without any special modification. The plant is largely used for packing glass, stuffing cushions, &c., especially in Venice. [For further details see order, also p. 168 and Schenk's *Wassergewachse*.]

**Zygadenus** Michx. Liliaceae (1). 10 sp. N. Am., Siberia.

**Zygopetalum** Hook. (incl. *Pescatorea* Rchb. f.). Orchidaceae (20). 20 sp. trop. Am., epiphytic. The base of the column forms a chin.

**Zygophyllaceae**. Dicotyledons (Archichl. Geraniales). 22 gen. with 140 sp. xero- or halo-phytes, trop. and subtrop. Most are woody perennials; leaves opp., stip., usually hairy, fleshy or leathery. Flrs. in cymes, regular, ♂. K 5; C 5; A 5 + 5; obdiplostemonous and with ligular appendages; G (5). Ovary 5-loc. with 1 or more pendulous ovules in each loc. Fruit usually a capsule. Seeds with or without endosperm. Guaiacum, Peganum, &c. furnish useful products. *Chief genera*: Zygophyllum, Guaiacum, Porlieria, Larrea, Peganum, Tribulus. Placed in Geraniales by Benth.-Hooker, in Terebinthinae by Warming. Closely related to Rutaceae.

**Zygophyllum** Linn. Zygophyllaceae. 60 sp. Old World, deserts and steppes. Leaves and twigs fleshy.

## SUPPLEMENT TO PART II.

### CORRECTIONS AND ADDITIONS.

**Acanthostachys**: after *A. strobilacea* add Link, Klotzsch et Otto.

**Acer**: in the floral formula, for G read G.

**Alternanthera**: insert (excl. *Mogiphanes* Mart.).

**Amherstia**: insert The young shoots are pendulous, their leaves reddish (pp. 167—8).

**Amygdalaceae** (Warming) = Rosaceae (sub-order V).

**Antennaria**: for cat's ear read cat's foot.

**Arundo**: after Gramineae, for (XI) read (X).

**Aspidium**: add *A. falcatum* Sw. exhibits apospory (cf. Filicineae).

**Asteriscus** Moench = *Odontospermum* Neck.

**Avellinia**: after Gramineae, for (XI) read (X).

**Azadirachta** A. Juss. = *Melia* Linn.

**Bacopa** Aubl. = *Herpestis* Gaertn.

**Baphia** Afzel. Leguminosae (III. 1.). 12 sp. trop. Afr. and Madagascar.  
*B. nitida* Afzel. supplies Camwood.

**Barringtonia**: insert [See p. 189.]

**Batatas**: for *Ipomaea* read *Ipomoea*.

**Beckmannia**: after Gramineae, for (X) read (XI).

**Betulaceae**: in fig. A, the number 1 refers to the leaf between 2 and 3, and should be joined to it by a dotted line.

**Blighia**: for *Blighia* read *Blighia*.

**Boretta**: for *Dabeocia* read *Daboecia*.

**Bouteloua**: after Gramineae, for (X) read (XI).

**Calamus**: after Palmae, for (III) read (III. 5).

**Calonyction**: for *Ipomaea* read *Ipomoea*.

**Camassea**: insert The bulbs (quamash) form a staple food of the Indians of N.W. Am.

**Canna**: after homodromous (line 7), insert (*i.e.* with all organs in similar positions in each flr.; in some cases, *e.g.* Marantaceae, the one flr. of a pair is like a reflection of the other, an organ which is to the right in one being to the left in the other).

**Cascarilla** : after Rubiaceae, for (1. 5) *read* (1. 4).

**Chamagrostis** Borkh. = Mibora Adans.

**Cheirostemon** : after the parenthesis, *insert* Sterculiaceae.

**Chickrassia** A. Juss. Meliaceae. 1 sp. Ind., *C. tabularis* A. Juss., useful for timber (bastard cedar, Indian red-wood, Chittagong wood, white cedar, &c.).

**Chloris** : after Gramineae, for (x) *read* (XI).

**Chrysanthemum** : *insert* (excl. *Tanacetum* Tourn.).

**Chukrasia** A. Juss. = Chickrassia A. Juss.

**Cinchona** : after Rubiaceae, for (1. 5) *read* (1. 4).

**Cleome** : *insert* (incl. *Polanisia* Rafin.).

**Coelogyne** : *insert* (incl. *Pleione* D. Don), and for 50 sp. *read* 60 sp.

**Esenbeckia** : after Rutaceae, for (2) *read* (v).

**Gesneriaceae** : the names of the sub-orders should be in italic capitals.

**Holcus** : after fodder, *insert* in Eur., but much used in Austr.

**Iridaceae** : the names of the suborders should be in italic capitals.

**Jubaea** : after Palmae, for (v. 7) *read* (IV. 7).

**Justicia** : *insert* (excl. *Dianthera* Gronov.).

**Kickxia** : *insert* *K. africana* Benth. is the source of Lagos rubber, in which a large trade has lately sprung up (see *Kew Bulletin*, 1895 and 1896).

**Lawsonia** : *henna* should be in Roman type.

**Marantaceae** : *insert* (line 4) The leaves sleep at night by bending upwards at the pulvini.

**Rhamnus** : for Caseara *read* Cascara.

## GLOSSARIAL INDEX OF ENGLISH NAMES, TECHNICAL TERMS, ETC.

ALL references to Vol. I quote the *page*, thus absciss-layer, 167, 28 refer to Vol. I, the fuller reference being mentioned first; all to Vol. II quote the *article*, thus "catechu, *Acacia*" refers to Vol. II.

A certain number of English and other names for plants have been incorporated in the Index, though not mentioned in the text of Part II.

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